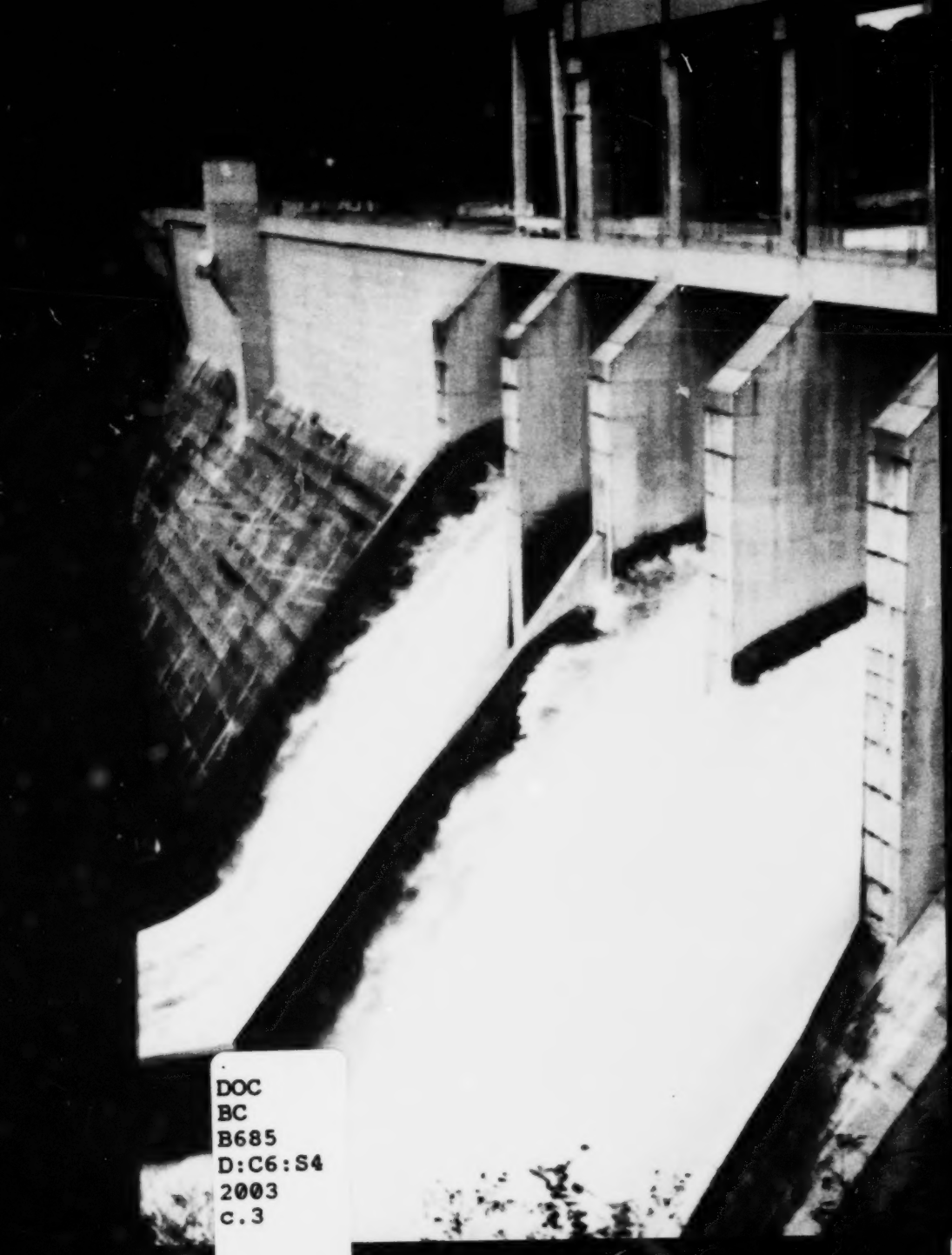

Consultative Report

February 2003

Prepared on behalf of:

The Consultative Group for the Seven Mile Dam and Generating Station Water Use Plan

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A Project of BC Hydro

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This report was prepared for and by the Seven Mile Dam and Generating Station Water Use Plan Consultative Group, in accordance with the provincial government's *Water Use Plan Guidelines*.

The report expresses the interests, values and recommendations of the Group and is a supporting document to BC Hydro's Seven Mile Dam and Generating Station Water Use Plan that will be submitted to the Comptroller of Water Rights for review under the *Water Act*.

The technical data contained within the Report was gathered solely for the purposes of developing the aforementioned recommendations, and should not be relied upon other than for the purposes intended.

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EXECUTIVE SUMMARY

Executive Summary

Introduction to Water Use Planning

Water Use Planning was announced in 1996 to ensure that provincial water management decisions reflect changing public values and environmental priorities. A Water Use Plan (WUP) is a technical document that, once accepted by the provincial Comptroller of Water Rights, defines how water control facilities will be operated. The purpose of a Water Use Planning process is to develop recommendations defining a preferred operating strategy using a public participatory process.

Background

The Seven Mile Dam and Generating facilities (referred to as the Seven Mile Dam hereafter) are located on the Pend d'Oreille River in the south-eastern portion of British Columbia, approximately 15 km south-east of the City of Trail. There are ten hydroelectric facilities on the Pend d'Oreille River upstream of the facility, with the closest being Seattle City Light's Boundary Project, 18 km upstream. Teck-Cominco's Waneta Project is located 9 km downstream.

The Seven Mile Project consists of a concrete gravity dam and a 4-unit powerhouse. The first three units were installed between 1979 and 1981, and the fourth unit is currently under construction with a scheduled completion date in the spring of 2003.

The Consultative Process

The Water Use Planning process for the Seven Mile Dam differs from most current Water Use Plan processes in that some of this Water Use Plan process for the Seven Mile Dam predates the creation of the provincial guidelines for Water Use Planning in British Columbia.

Public consultation around operations of the Seven Mile Dam began in the late 1980s with the initiation of planning for the addition of the fourth generating unit. Consultation continued up until late 1996 when a draft Water Use Plan was written by BC Hydro, outlining its intended operations for the facility. From late 1996 to June 1998, the Seven Mile Water Use Plan underwent several revisions, both to address points raised by those involved in the review process (DFO, MELP, MEI, CCRIFC) and to keep abreast with the then emerging provincial Water Use Plan guidelines.

By June 1999, several parties [Fisheries and Oceans Canada (DFO), Ministry of Environment, Lands, and Parks (MELP), Canadian Columbia River Inter-Tribal Fisheries Council (CCRIFC)] had pointed out that, although the consultative process to date had addressed the incremental impact of adding a fourth unit to the Seven Mile Generating facilities, the Water Use Plan had not addressed the overall operations of the Seven Mile Dam. An interagency meeting in July 2000 consisting of BC Hydro, MELP, DFO and CCRIFC recommended that additional, limited consultation was needed regarding the overall operation of the Seven Mile Dam.

This document outlines the additional consultation recommended by the interagency group in July of 2000. These additional meetings consisted of representatives from a range of agencies that had interests in impacts on power generation and on fish. This additional consultative process extended from December 2000 to January 2002 and included four meetings to work through the steps outlined in the *Water Use Plan Guidelines*. The consultation undertaken by BC Hydro from 1989 to 1999 is summarized in Appendix G (Draft Consultation Report of the Seven Mile Dam and Generating Station Water Use Plan).

Issues

Because of its relatively small reservoir size and the high value to its energy generation, it was recognized early on that only marginal changes would be considered to the Seven Mile Dam operations. Given these limitations, however, the consultative group was interested in tracking the impacts of Seven Mile Dam activities on several issues discussed below.

One issue of interest was the impact of changes in operations on fish in the reservoir. Further investigation showed that the reservoir is contaminated by mine tailings, receives a steady input of exotic fish species from the United States, and generally has a low level of productivity. For these reasons, the group decided not to investigate changing operations to enhance reservoir productivity for fish.

A second area of concern for the group was regarding the entrainment of bull trout through the generating units during deep and rapid drawdowns of the reservoir. Divergent opinions existed within the group as to whether the entrainment of bull trout was occurring, and as to whether entrainment of bull trout was a significant enough issue to warrant considering operational (or physical) changes. Further exploration of this issue was hampered by a lack of information on this topic.

The impact of rapid flow fluctuations on fish below the Seven Mile Dam was also a concern for the group. While the group agreed that the habitat below the dam was of poor quality for spawning and rearing, the concern remained that fish could be stranded during rapid flow decreases.

Finally, a pressing concern for the group was the impact of Seven Mile Dam operations on white sturgeon below Waneta Dam. The restricted storage in the Seven Mile reservoir and the presence of another operator downstream limited the range of options that could address white sturgeon downstream of Waneta. However, operations of Seven Mile Dam are connected to those at Waneta Dam, and therefore may contribute to impacts such as flow fluctuations and altered Total Gas Pressure (TGP) levels in white sturgeon spawning areas downstream of the Waneta Dam.

Objectives and Performance Measures

The consultative group explored issues and interests affected by facility operations and agreed to a preliminary set of objectives that can be roughly described as follows:

1. Maximize the value of power generated;

2. Maximize the productivity of the reservoir for fish;

3. Minimize the negative impact of operations on fish below the Seven Mile Dam;

4. Minimize the negative impact of operations on fish below the Waneta Dam.

Discussions around performance measures were based on these objectives. Since these discussions remained at a relatively high level and detailed alternatives were not modelled, performance measures remained mostly qualitative in nature.

Creating Alternatives

Operating alternatives were then generated to meet the objectives listed above. In total, five alternatives were considered by the group. These alternatives were conceptual and did not require power modelling.

Lessons Learned

Given the high value of the power generated by the facilities and the low productivity of the reservoir, it was agreed that addressing reservoir productivity for fish through changes in operations was not desirable for the group.

A second lesson learned was that potential sites where the stranding of fish below the dam may be an issue are limited in number. Consequently, addressing this through recontouring the channel would be a much cheaper solution than through operational changes such as minimum flows or ramping restrictions.

Finally, the group concluded that there are no additional improvements to current operations that can be implemented to address concerns around white sturgeon below Waneta Dam, and so the existing constraints on operations should be retained.

Recommendations for Operations[1]

The group agreed by consensus that the current operating regime for the Seven Mile Dam should not be changed. A general description of this can be captured by the following elements:

- During low flow periods when inflows to the Seven Mile Dam are less than the capacity of the Waneta powerhouse, BC Hydro will make reasonable efforts to operate Seven Mile Dam in order to minimize spill at Waneta Dam. This typically happens outside of freshet, from late July to mid-March;
- During high flow periods, when inflows are greater than the capacity of Seven Mile powerhouse, BC Hydro is free to choose how much water to pass through the generators at Seven Mile Dam. This typically occurs during freshet, from May to early July;
- During periods when inflows to the Seven Mile Dam are less than the capacity of its powerhouse but more than the capacity of the Waneta powerhouse, BC Hydro will try to plan operations at Seven Mile Dam in order to minimize spill at Waneta Dam;
- No restrictions on the rate that flows are ramped up or down;
- Reservoir operations are generally limited to a maximum level of 527.3 m and a minimum of 515.0 m;
- Reservoir fluctuations are limited to 4 m maximum daily fluctuation from 1 June to 31 August, with a 0.6 m per hour maximum drawdown rate;
- Reservoir fluctuations are limited to 6 m maximum daily fluctuations from 1 September to 31 May, with a 1.2 m per hour maximum drawdown rate.

As well, the group recommended that, if stranding of fish below the dam in three key areas poses a significant issue, then recontouring of the channel will take place. While the costs of this are unknown, a conservative estimate set the maximum to be $50,000.

Monitoring

The group felt there existed enough uncertainty around the impacts of fish stranding below the dam and entrainment of bull trout through the dam that monitoring programs were developed to address these issues.

[1] A more detailed description can be found in Section 2.6.

BC Hydro agreed to fund a study that would assess the potential stranding risk for fish below the dam. If the information shows that three specific areas pose a stranding risk, then channel recontouring will be undertaken. Since this is being funded by BC Hydro, its costs are not being recorded against this Water Use Plan.

The group agreed to recommend a study that will track radio-tagged bull trout from the Salmo river to help determine whether these fish are being entrained through the dam. The proposal will cost roughly $30,000 per year for five years and will help future decision-makers assess whether operational changes (or physical changes in lieu of operational changes) are warranted to decrease the entrainment of bull trout through the dam.

Review Period

The group recommended that this Water Use Plan be reviewed when the earliest of the following four events occurs:

1. Imminent, significant changes to upstream facilities or operations. It is anticipated that this includes, but is not limited to, physical changes to Boundary Dam and Federal Agency Regulatory Commission (FERC) relicensing of that facility;

2. Imminent, significant changes to downstream facilities. It is anticipated that this includes, but is not limited to, an expansion of the Waneta facilities;

3. Emergent water use issues. It is expected that this may include, but not be limited to, the establishment of a strong link between bull trout entrainment and dam operations at the end of the 5 year monitoring program, or new information making a strong link between white sturgeon and dam operations; and

4. Ten years after this Water Use Plan is accepted by the Comptroller of Water Rights

Conclusion

In summary, the consultative group came to an agreement on a recommended operating strategy for the Seven Mile Dam and Generating facilities and on the elements of a monitoring program.

The consultative process itself provided a forum to share information and promote understanding of various affected interests and perspectives, explore alternative ways to operate the facility, evaluate impacts in a structured way and thus make choices more explicit. This participatory form of 'recommendation-making' provides accountability and an assessment of current public values to make more informed water management decisions in the province.

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1 INTRODUCTION

Water Use Planning was announced in 1996 jointly by the Minister of Employment and Investment and the Minister of Environment, Lands and Parks to ensure provincial water management decisions reflect changing public values and environmental priorities. A Water Use Plan (WUP) is a technical document that, once accepted by the provincial Comptroller of Water Rights, defines how water control facilities will be operated. The purpose of a Water Use Planning process is to understand the physical implications of various water use options, public values around these and to develop recommendations defining a preferred operating strategy using a participatory process.

Water Use Planning processes are intended to address issues related to the operation of facilities as they currently exist and incremental changes to operations to accommodate other water uses.[1] Water Use Plans are not intended to be comprehensive watershed management plans, nor are they to deal with water management issues associated with other activities in the watershed. Treaty entitlements and historic grievances from facility construction are specifically excluded from Water Use Plans, but can be considered as part of other processes (Province of British Columbia, 2000).

This report documents the consultative process and presents recommendations to BC Hydro and the Comptroller of Water Rights. The interests and values expressed in the recommendations will be used by BC Hydro to prepare a draft Water Use Plan for the Seven Mile Dam and Generating Station. Both this consultative report and BC Hydro's draft Water Use Plan will be submitted to the provincial government for review and approval by provincial and federal government agencies as outlined in the Water Use Plan Guidelines (Province of British Columbia, 1998).

This report is a record of the water use issues and interests identified for the Seven Mile Dam and Generating Station and the analysis of trade-offs associated with operating alternatives. It ensures the Comptroller of Water Rights has more complete information from participants for use in decision-making.

[1] The focus of a Water Use Plan is to determine how water could be allocated to accommodate different uses. However, there may be opportunities to undertake physical works as a substitute for changes in flow if the physical works can achieve the same outcome as changes in flow but at less cost.

2 DESCRIPTION OF THE SEVEN MILE DAM AND GENERATING STATION PROJECT

2.1 Communities and Transportation Links

The Seven Mile Dam and Generating Station are situated on the Pend d'Oreille River in south-eastern British Columbia, approximately 15 km south-east of the City of Trail. The project is 18 km downstream of Seattle City Light's Boundary Project and 9 km upstream from Teck-Cominco's Waneta Project.

Access to the project is by well-maintained paved two-lane highways. Approaching from the west, follow Provincial Highway 3B east from Trail about 4 km to the junction with Highway 22A. Turn off and follow Highway 22A south for about 6 km to the junction with the Waneta-Nelway Road. Follow the Seven Mile Dam Road east to the dam and generating station.

Approaching from the east on Highway 3A, the junction with Highway 22A is about 8 km west of Fruitvale. Turn south and proceed to project as above.

Rail access is provided by the Burlington Northern Railway. A railway siding is located adjacent to the junction of Highway 22A with the Waneta-Nelway Road.

Project location is shown in Figure 2-1.

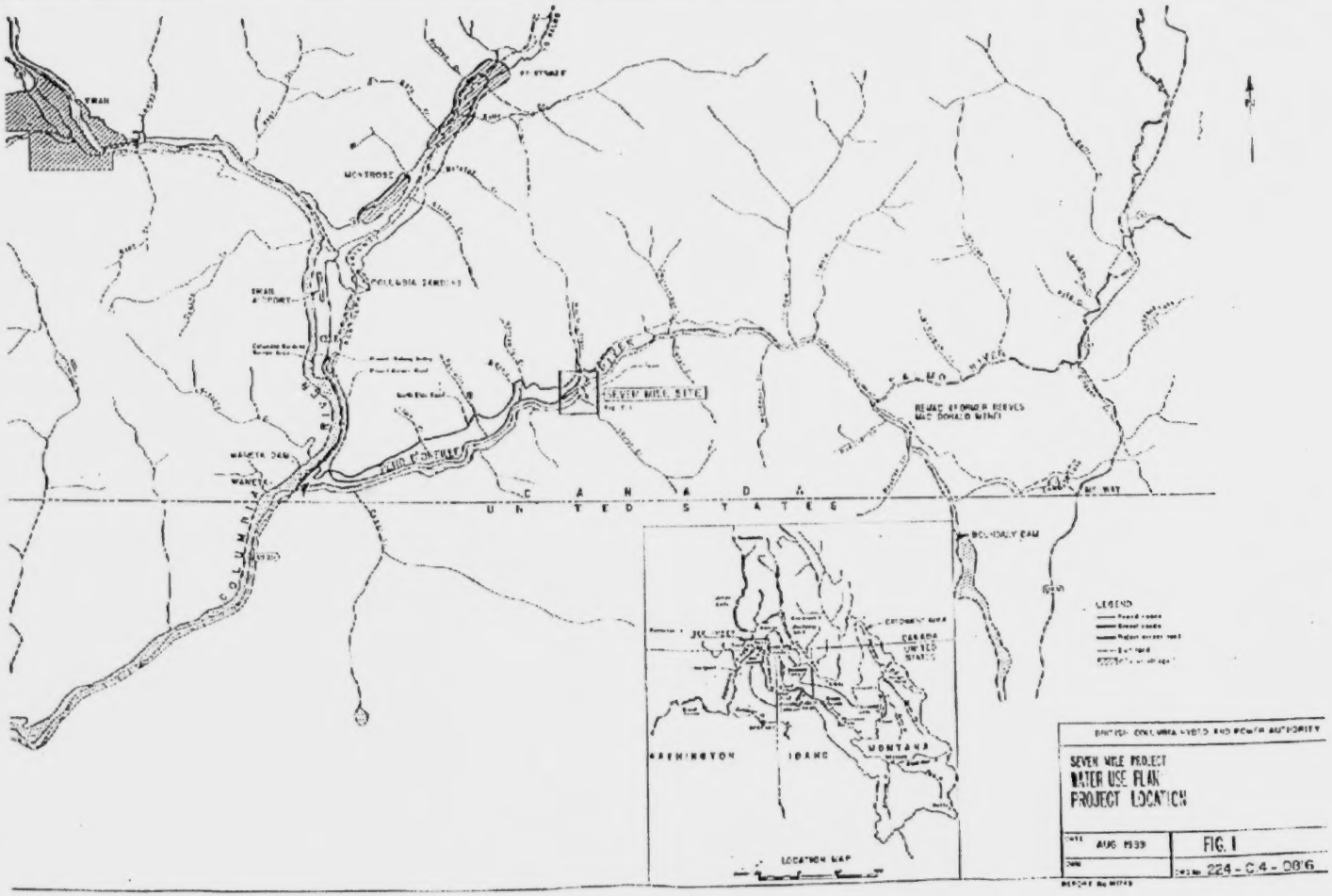

Figure 2-1 Location of the Seven Mile Project within the Columbia River Basin

2.2 Description of the Drainage Basin

The location of the Seven Mile project within the Columbia River basin is shown in the Figure 2-1.

The Pend d'Oreille River enters Canada from the United States and flows for about 25 km in Canada before joining the Columbia River just north of the International Boundary. The Pend d'Oreille River drains some 69 000 km^2 of western Montana, northern Idaho, north eastern Washington, and south eastern British Columbia. Less than 5000 km^2 are in Canada. The river basin is generally mountainous and is largely forested.

The main tributaries of the Pend d'Oreille are the Flathead, which rises in the south-east corner of British Columbia and the Blackfoot, Bitteroot and Clark Fork rivers which flow into Pend Oreille Lake[1], in Idaho. From there, the Pend Oreille River flows westerly through Idaho, northerly through Washington, and into British Columbia where it is joined by the tributary Salmo River. In Canada, the Pend d'Oreille turns westerly, flowing in a 25 km loop before joining the Columbia River just north of the International Boundary, about 15 km downstream from Trail, B.C. There are ten hydroelectric developments on the Pend d'Oreille and its tributaries in the United States upstream from Seven Mile, which provide substantial flow regulation for Seven Mile and other developments downstream.

2.3 Description of the Facilities

2.3.1 Project Description

The Seven Mile Dam and Generating Station were built between 1975 and 1980 and consist of a concrete gravity dam with a maximum height of 80 m, incorporates a 4 power intake, a 5-bay gated spillway, and a 4-unit powerhouse. Spillway flows are controlled by vertical lift gates and discharge over ogee crests into a divided chute with two flip buckets. The powerplant was designed as a four unit facility which would be in approximate hydraulic balance with the ultimate six unit development at the Boundary development upstream. The first three units, installed between 1979 and 1981, have a nameplate capacity of 202.5 MW each. The fourth unit, scheduled for service in the spring of 2003, will have a nameplate capacity of 210 MW, and will bring total plant nameplate capacity up to 817.5 MW.

Since its completion in 1980, the project has been inspected and maintained by BC Hydro. As part of its dam safety program, BC Hydro updates and re-evaluates design and operating criteria for the dam and facilities on an ongoing

[1] Note the American spelling of Pend d'Oreille is Pend Oreille.

basis. Improvements or changes to operating procedures are made as required to ensure the long term safety of the dam.

The original three units at Seven Mile were in approximate hydraulic balance[1] with the original four units of the Boundary Plant upstream. Seattle City Light added two more units at Boundary in 1985; installation of Unit 4 at Seven Mile will re-establish the hydraulic balance.

Seven Mile project features are summarized in Table 2-1. Project arrangement is shown in Figure 2-2.

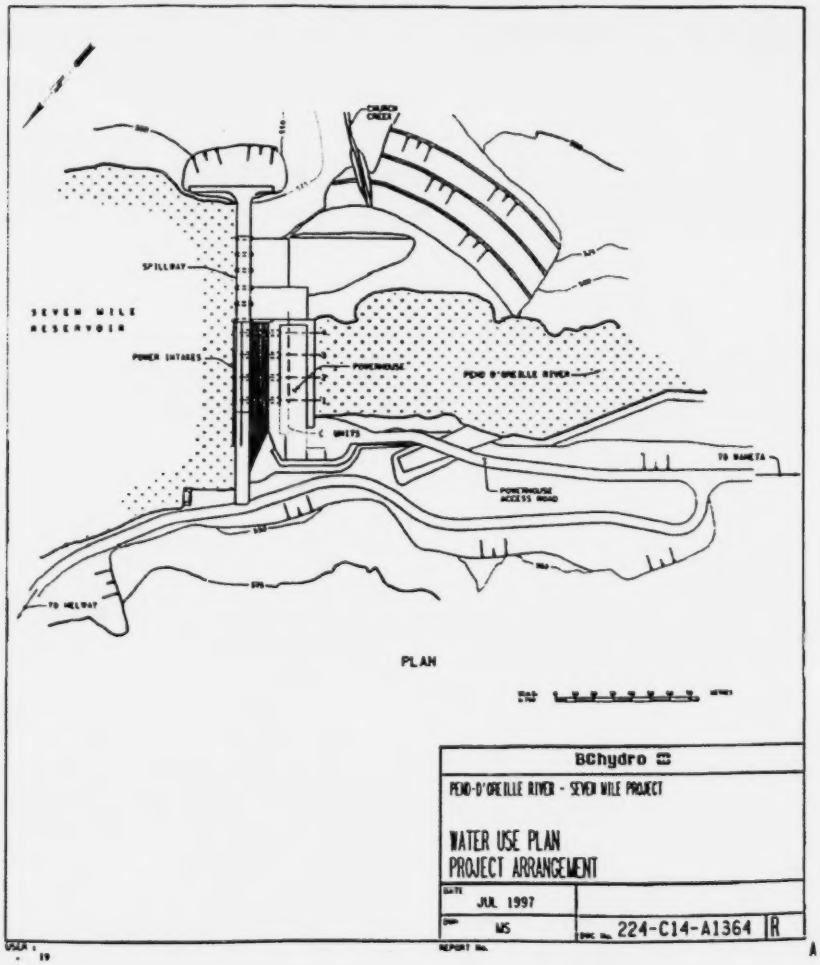

Figure 2-2 Seven Mile Project Arrangement

[1] Hydraulic balance means the total discharge capacity of the turbines at each plant are similar.

2.3.2 Electricity Production

Energy generation from the plant with three units in service averages about 3200 gigawatt-hours per year (GWh/yr)[1], 6% of BC Hydro's system capability. This is enough electricity to supply about 320 000 homes. Unit 4 will boost Seven Mile's annual energy output by more than 300 GWh, enough for an additional 30 000 homes.

The existing plant capacity of about 600 MW also represents about 6% of the system's installed capacity. The commissioning of Unit 4 will boost this to 8%. Power from Seven Mile is transmitted into the provincial grid via two 230 kV lines to Selkirk substation.

Annual value of Seven Mile generation, based on BC Hydro's average revenue of 4.85 cents/kWh in 1995/96, is approximately $150 million. Water rentals contribute about $13 million annually to the province.

2.3.3 New Works

When the powerhouse was originally constructed, space was provided for installation of a similar unit in Bay 4. The power intake gates and the penstock for Unit 4 are already in place. The downstream end of Penstock 4 is currently terminated by a steel bulkhead. First stage construction of Bay 4 was essentially the same as for the other units, modified by temporary draft tube bulkhead walls and some draft tube geometry changes. Unit 4 and auxiliary equipment will be similar to the three existing units, but will incorporate technical improvements that have occurred since the first three units were installed. Unit 4 will have a slightly higher capacity than the other three (210 MW), as it was found to be cost-effective to install the higher output unit into the existing space. Technical details of Unit 4 are also presented in Table 2-1. There is no significant change to total facility operations with the addition of Unit 4.

Table 2-1 Key Facility Parameters

RESERVOIR	
Location	Pend d'Oreille River, 10 km upstream from confluence with Columbia River
Water Levels	Maximum Normal Reservoir Level 527.3 m
	Minimum Operating Level 515 m
	Maximum Flood Level 527.9 m
Capacity	Total 104 m x 10^6 m^3 at MNRL 527.3
	Active 45.5 m x 10^6 m^3 between 515.0 m and 527.3 m
Surface Area	405 ha at MNRL
Length	15 km

1 One gigawatt-hour equals one million kilowatt-hours.

DAM	
Type	Concrete gravity
Foundation	Granite, argillite, lamprophyre and diabase dykes or sills
Length	347 m
Maximum Height	80.0 m from foundation below drainage sump to deck
Top Width	Power intakes section and part of north gravity section
	19.56 m; south gravity section and remainder of north gravity section 16.31 m; spillway bridge 8.53 m
Top Elevation	530.35 m
SPILLWAY	
Location	Part of concrete gravity dam in left side of riverbed
Type	Five 15.24 m wide 16.59 m high vertical lift gates over ogee crests discharging into a divided chute with two flip buckets
Crest Level	511.76 m
Design Capacity	10 500 m^3/s at reservoir El. 527.76m
POWER INTAKES AND PENSTOCKS	
Location	Part of concrete gravity dam in right side of riverbed
Intakes	Four 6.10 m wide 10.01 m high operating gates
Intake invert level	483.11 m
Penstocks	Steel, 44.56 m long 7.62 m diameter, reducing to 7.31 m diameter at the downstream end
POWERHOUSE	
Location	Toe of dam in right side of riverbed.
Type	Conventional enclosed surface powerhouse
Rated Capacity	Units 1-3: 202.5 MW each; Unit 4 210 MW. Total 817.5 MW
Turbines	Units 1-3: Francis type, 94.7 rpm, rated output 197.6 MW @ 62.48 m net head, rated power flow per unit 362.2 m^3/s; maximum output 205.1 MW @ 65.53 m net head, maximum power flow per unit 362.2 m^3/s.
	Unit 4: Francis type, rated output 213 MW @ 61.6 m net head, rated power flow 378.2 m^3/s; maximum output 223 MW @ 64.3 m net head, maximum power flow 378.2 m^3/s.
Generators	Units 1-3: Vertical shaft umbrella type, 225 MVA, 0.90 PF, 3-phase, 60 Hz, 13.8 kV.
	Unit 4: Vertical shaft umbrella type, 233.3 MVA, 0.90 PF, 3-phase, 60 Hz, 13.8 kV.
Transformers	One 3-phase generator transformer per generator, located ondeck upstream of powerhouse.
	Units 1-3: rated 225 MVA, 13.8/236 kV, delta to wye connected.
	Unit 4: rated 233/270 MVA, 13.8/236 kV, delta to wye connected.
SWITCHGEAR	
Location	Deck on upstream side of powerhouse.
Switchgear	Units 1-3: SF6 CGI, 230 kV circuit breakers rated 2000 A and maximum interrupting capacity 50 kA rms serving two 230 kV transmission lines to Selkirk substation.
	Unit 4: SF6 CGI, 230 kV circuit breaker rated 1250 A, 31.5 kA interrupting capacity.

CONSTRUCTION	
Contract award - turbine supply	May 1975
Contract award - dam, spillway, powerplant construction	September 1976
Completion of civil works prerequisite to reservoir filling	November 1979
Commissioning of Unit 1	December 1979
Commissioning of Unit 2	March 1980
Commissioning of Unit 3	January 1981
Commissioning of Unit 4 (scheduled)	March 2003

2.4 System Hydrology

2.4.1 Runoff Distribution

The streamflow characteristics of the Pend d'Oreille River follow the typical pattern of snowmelt dominant basins, with below average flows during the fall and winter, followed by a rapid flow increase in April, with the flood peak normally occurring in May or June, and a gradually declining flow during the summer. Records show the annual flood peak occurring between 15 May and 15 June approximately 72% of the time, prior to 15 May about 5% of the time, and after 15 June about 23% of the time. Average annual discharge at the Seven Mile project site is approximately 763 m^3/s. Extreme and average monthly flows based on the period of record 1913 to 1990 are shown on Table 2-2. The envelope of daily flows based on the period 1949 to 1991 is shown on Figure 2-3.

Major storage reservoirs constructed upstream of Seven Mile since 1939 have modified the natural streamflow hydrograph. The major storages affecting flood peak attenuation are:

- Kerr Project (Flathead Lake), completed 1939
- Hungry Horse Project, completed 1952
- Albeni Falls Project (Pend Oreille Lake), completed 1955

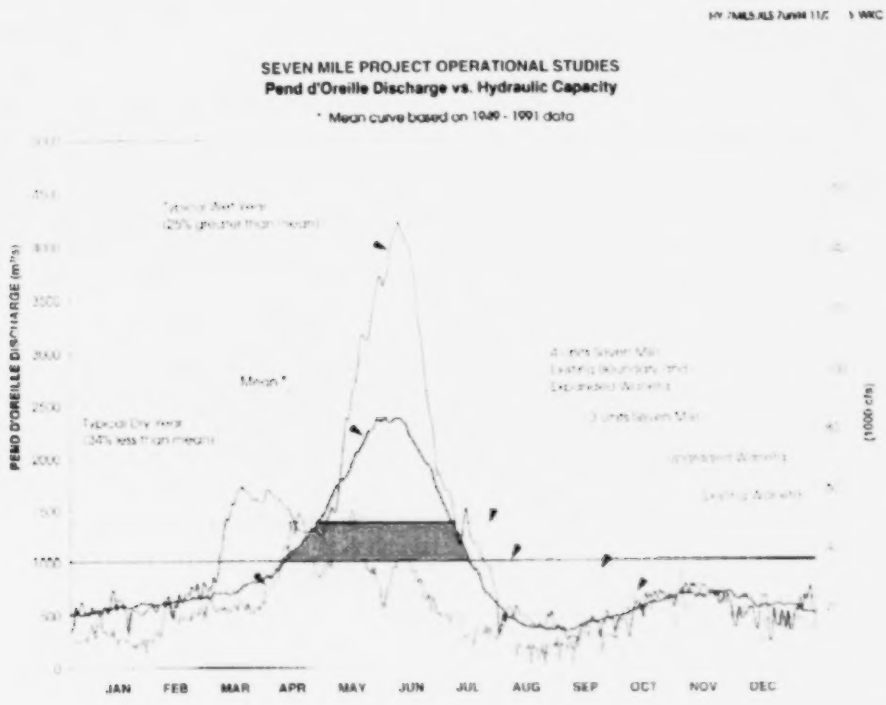

Figure 2-3 Extreme and Mean Monthly Flows Based on the Period of Record 1913-1990

Table 2-2 Monthly Mean Discharge at Seven Mile

Month	Minimum Recorded (m^3/s)	Mean	Maximum Recorded (m^3/s)
January	135	453	1240
February	151	478	974
March	206	540	1150
Aprril	221	802	1800
May	494	1560	2750
June	471	1990	4460
July	215	1080	3300
August	239	444	1310
September	192	373	690
October	181	461	920
November	183	504	972
December	179	457	950
Mean	-	763	-

Figure 2-4 shows the effect of regulation by the upstream projects on the natural unregulated hydrograph of the Pend d'Oreille River. It can be seen that upstream regulation results in the following changes to the hydrograph:

- a reduction in the peak discharge
- higher flows in the October-December period

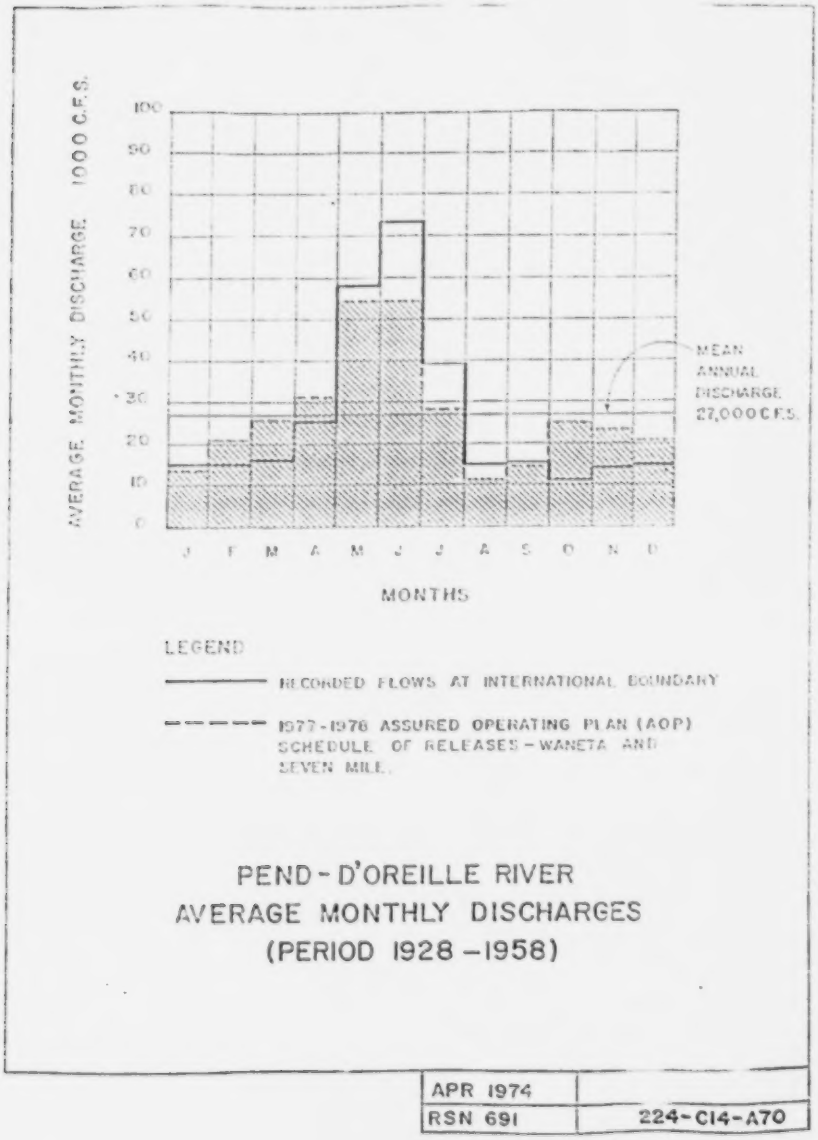

Figure 2-4 Effect of Regulation by the Upstream Projects on the Natural Unregulated Hydrograph of the Pend d'Oreille River

The Seven Mile project has no material impact on the seasonal pattern of the Pend d'Oreille River hydrograph due to the limited storage in its reservoir. It only has sufficient capacity for daily pondage, and as such does not affect weekly or seasonal Pend d'Oreille River flows.

The Seven Mile project was designed to be in hydraulic balance with the upstream Boundary plant and the normal reservoir fluctuation was assumed to be small. However, under the provisions of the Kootenay Canal Plant Agreement, it is beneficial for BC Hydro to operate Seven Mile and Waneta in a coordinated manner to maximize overall benefits. For this reason, and the agreements with regulatory agencies respecting flows for white sturgeon downstream of Waneta, the Seven Mile Reservoir fluctuates by up to 6 m on a daily basis in order to re-regulate flows from the Boundary plant to minimize spill at the Waneta plant downstream. Since both the upstream and downstream facilities from Seven Mile are owned independently, there is limited control by BC Hydro in regards to regulating the inflow of water.

2.4.2 Inflow Forecasting

BC Hydro does not maintain any streamflow gauges or hydromet stations within the Seven Mile basin (from the Canadian border to Seven Mile GS). The project's location and limited storage precludes any need for such equipment. Daily Pend d'Oreille River flows are regulated through the discharges from the Boundary project. The Boundary project's generation discharge is available to BC Hydro operators on a continuous basis. Seattle City Light, operator of the Boundary project, provides BC Hydro operators with the anticipated generation schedule for the following day.

On a longer term basis, Pend d'Oreille flow projections are available through the US Army Corps of Engineers (Corps) and Bonneville Power Administration (BPA) Internet pages and regular conference calls with BC Hydro operations staff. The Corps maintains a model of the Pend d'Oreille basin. This information is utilized by both the Corps and BPA to plan operation of the entire Columbia basin. BPA also maintains several spreadsheet models of the Columbia basin (30 and 90 day models). Summaries of these operation models are sent to BC Hydro operators on a regular basis to co-ordinate operation of the Columbia projects.

The US forecast model is maintained and reviewed by several US agencies. BC Hydro is satisfied with the model's accuracy and maintenance.

The Salmo river, which discharges into the Seven Mile forebay, has a monthly volume forecast prepared by BC Hydro's operations staff. This forecast is prepared using BC Hydro's VOLCAST program utilizing data from the following BC Environment snowcourses: Nelson, Char Creek and Record Mountain.

Due to the relatively small volumes flowing from the Salmo compared to flows on the Pend d'Oreille , BC Hydro believes that the modelling for the Salmo is sufficient at this time.

2.5 Operating Conditions for the Facility

2.5.1 Demand for Water at the Facility

Virtually all of the Pend d'Oreille River flow which is licensed to BC Hydro passes through the Seven Mile Generating Station.

Maximum flow through all three turbines is physically limited to about 1122 m^3/s. With the addition of the fourth unit, Seven Mile would increase it's turbine capacity to 1473 m^3/s, which is the maximum diversion amount authorized by the water licences. Daily average flows are determined by the flows passed from Boundary Dam upstream. Flows in excess of turbine capacity are spilled.

There are no minimum flow requirements. Occurrences of zero discharge from the powerplant are common when the average flows in the river are less than the capacity of the plant. Under zero discharge conditions, the minimum depth of water in the channel downstream of the plant, with Waneta Reservoir drawn down to its minimum operating level, is greater than two metres.

2.5.2 Pattern of Water Use

The pattern of water use for power purposes at the Seven Mile project is governed by:

1. the amount of flow in the river,
2. water licence limits, and
3. the hydraulic capacity of the Seven Mile plant in relation to the capacities of the upstream Boundary plant and the downstream Waneta plant.
4. daily distribution of discharge from Boundary
5. system load

The hydraulic capacities of the three plants are as follows:

Plant	**Capacity**
Boundary	1420 m^3/s
Seven Mile (3 Units)	1122 m^3/s
Seven Mile (4 units)	1473 m^3/s
Waneta (no upgrades)	708 m^3/s
Waneta (4 upgrades)	875 m^3/s

The hydraulic capacities of the generating stations in relation to the average monthly flow in the Pend d'Oreille River at Seven Mile are shown in Figure 2-3. When flow in the river is greater than capacity, spill must occur. This means that in most years there is spill at all plants during the months of May, June and early July.

Two key factors govern the operation of the Seven Mile/Waneta system:

1. typically daily flows from the upstream Boundary plant are released in a 15-hour maximum flow block (6:00 a.m. to 9:00 p.m.) and a 9-hour minimum block (9:00 p.m. to 6:00 a.m.). The maximum flow block can be up to 1420 m^3/s and the minimum flow block is often zero discharge; and

2. the Kootenay Canal Agreement[1] and agreements with Fish Agencies require BC Hydro make it beneficial to re-regulate Boundary discharges at Seven Mile to prevent/reduce spill at Waneta.

Re-regulation of inflows from Boundary to minimize spill at Waneta causes the Seven Mile reservoir level to fluctuate by up to 6 m on a daily basis. To determine the amount of re-regulation necessary, BC Hydro Power Supply Operations takes into account expected Boundary discharges, potential spills, head losses due to reservoir drawdown, environmental constraints, and variations in energy values throughout the day. Re-regulation is required at any time the flow in the river is less than the hydraulic capacity of Boundary, i.e. when Seattle City Light shapes the flow from Boundary as described in Item 1 above. This situation occurs most of the year, except for the freshet period from May to early July. During the freshet, average river flows are typically greater than Boundary capacity, and are sufficient to run all three plants at full output around

[1] Under the terms of the Kootenay Canal Agreement between BC Hydro, Teck-Cominco and Aquila, BC Hydro dispatches power from Teck-Cominco and Aquila power plants on the Kootenay and Pend d'Oreille Rivers.

the clock. Water levels at all three reservoirs can then be kept at maximum operating level with little daily fluctuations. Excess water is spilled under these conditions.

Short-term peaking operations (i.e. running three or four Seven Mile units for a few hours a day) can also affect reservoir levels, particularly at Waneta. The need for short-term peaking occurs primarily during the winter months (generally mid-November to mid-February but occasionally extending into other months). Because the turbines at Seven Mile can pass more water than those at Waneta, it is occasionally necessary to draw down Waneta Reservoir overnight to create some storage space in the reservoir to absorb the extra discharge from the Seven Mile units the next day without causing a spill at Waneta. Occasionally, short-term peaking operations at Seven Mile may cause additional spill at Waneta.

Historically, short-term peaking operations which cause additional spill at Waneta have been uncommon. Future increases in the value of capacity and/or energy may result in more frequent fluctuation of Waneta Reservoir up to its full 4.9 m range to minimize spill at Waneta, or in some additional spill. This will be managed in accordance with agreements with fisheries agencies as described in this section.

2.6 Current Operation with Three Units at Seven Mile

2.6.1 General

Daily average river flows at Boundary Dam are less than turbine capacity and the facility is therefore operated as a peaking plant, shaping most daily discharge into the heavy demand hours (6 a.m. to 9 p.m.). Since both Seven Mile and Waneta have lower discharge capacities than Boundary, the Seven Mile Reservoir fluctuates daily in order to re-regulate Boundary discharges.

2.6.2 Turbine Operations

(a) Average Daily Flows 708 m^3/s or Less

The hydraulic capacity of Waneta powerhouse with no upgrades is 708 m^3/s. Average daily flows are generally 708 m^3/s or less between late July and mid-March, i.e. all year except for the spring freshet period. Under these flow conditions, most of the Boundary discharge is released during heavy-load hours (modelled as a 15-hour maximum flow block from 6:00 a.m. to 9:00 p.m.), with little flow during the remaining hours. Turbine flows at Seven Mile are established to distribute the flows throughout the day in such a way that spilling at Waneta is usually avoided. This requires that the Seven Mile reservoir level fluctuate by up to 6 m to re-regulate the Boundary flows.

Short-term peaking operations may be undertaken at Seven Mile during periods of high demand, usually the winter months. In most cases, the Waneta Reservoir is drawn down overnight as necessary to create enough pondage space in the Waneta Reservoir to absorb the extra discharge the next day without causing spill at Waneta. In periods of unusually high system demand, however, BC Hydro may undertake short-term peaking operations at Seven Mile which may cause spill at Waneta.

In consideration of potential adverse impacts of additional spilling on white sturgeon habitat downstream, BC Hydro has agreed with the fisheries agencies to plan operations at Seven Mile in accordance with the following condition:

> During periods when the daily average Pend d'Oreille River discharges at Seven Mile are less than the capacity of the Waneta powerhouse, BC Hydro shall make reasonable efforts[1] to distribute discharges from the Seven Mile powerhouse such that the total instantaneous discharge at the Waneta facilities does not exceed the capacity of the Waneta powerhouse. In the event that actual discharges at Seven Mile cannot be distributed in this way due to:
>
> (i) unexpected changes in inflows or inflow shaping from the upstream Boundary plant,
>
> (ii) unforeseen high discharges in the Salmo River,
>
> (iii) a need to respond to system demand in excess of BC Hydro generation capacity with no spill[2] at Waneta, or
>
> (iv) limits on permissible water level fluctuations of Seven Mile Reservoir,
>
> then BC Hydro shall make reasonable efforts[1] to distribute discharges from Seven Mile powerhouse such that:
>
> (a) spilling at Waneta is minimized, and
>
> (b) the total instantaneous discharge at the Waneta facilities does not exceed the capacity of the Waneta powerhouse by

[1] The following is meant by the terms "reasonable efforts" and "best efforts": "best efforts means BC Hydro will do everything short of cutting firm load or incurring legal liability for operations at Seven Mile or elsewhere to keep from increasing spill at Waneta; "reasonable efforts" allows for consideration of economics in prioritizing the options for responding to system demands.

[2] "No spill" in the context used in this condition means no spilling of water forced at a downstream plant as a consequence of the turbine capacity at the downstream plant being less than that of the upstream plant.

more than 14 000 cfs, i.e. any more than could occur with three units at Seven Mile in combination with four units at Waneta prior to any of the Waneta units being upgraded.

During the critical white sturgeon spawning/hatching period of June, July and August, BC Hydro shall make best efforts[1] to observe this condition.

(b) Average Daily Flows Between 708 m^3/s and the capacity of the Seven Mile powerhouse.

Daily flows are in this range generally during April and July, i.e. the transition periods leading up to and tailing off from the freshet, and also in significant storm events at other times of the year.

Under these conditions, flow at Boundary is typically released in a 15-hour maximum flow block of 1420 m^3/s from 6:00 a.m. to 9:00 p.m., and a 9-hour minimum flow block during the remaining time. Turbine flows at Seven Mile are typically established to distribute the flows such that Waneta is kept at full load throughout the day. Flows in excess of 708 m^3/s at Waneta are spilled. Normally, no water is spilled at Seven Mile.

To minimize potential adverse impacts of spilling on white sturgeon habitat downstream, BC Hydro has agreed with the fisheries agencies to plan operations at Seven Mile in accordance with the following condition:

During periods when the daily average Pend d'Oreille River discharges at Seven Mile are greater than or equal to the capacity of the Waneta powerhouse, BC Hydro shall make reasonable efforts[1] to distribute discharges from Seven Mile powerhouse such that the powerhouse at Waneta may be run effectively at full capacity for 24 hours per day.

During the critical white sturgeon spawning/hatching period of June, July and August, BC Hydro shall make best efforts[1] to observe this condition.

(c) Average Daily Flows Greater than the capacity of the Seven Mile powerhouse.

In an average year, daily flows are greater than 1122 m^3/s during May and June and early July. Under these conditions, all three plants (Boundary,

[1] The following is meant by the terms "reasonable efforts" and "best efforts": "best efforts means BC Hydro will do everything short of cutting firm load or incurring legal liability for operations at Seven Mile or elsewhere to keep from increasing spill at Waneta; "reasonable efforts" allows for consideration of economics in prioritizing the options for responding to system demands.

Seven Mile and Waneta) are typically run at full output around the clock, with all water in excess of turbine capacity being spilled.

During years when a system spill is required, Seven Mile turbine discharge may be backed off in order to increase generation at other plants in the system e.g. GMS or Mica, with a corresponding increase in the amount of water spilled at Seven Mile, and a corresponding decrease in spill elsewhere. The total discharge passing Seven Mile and Waneta would not be affected.

The above conditions in Items a, b and c apply when all four units at Seven Mile and all four units at Waneta are operational and capable of running at full capacity, and as long as BC Hydro continues to be a party to the Kootenay Canal Agreement.

Should the results of any environmental monitoring carried out downstream of Waneta by BC Hydro or others indicate that relaxation of any of the above conditions is justified, BC Hydro may approach the Fisheries and Oceans Canada (DFO) with a request to relax the conditions and DFO shall consider the request.

2.6.3 Spillway Gate Operations

The maximum normal operating level of Seven Mile Reservoir is El. 527.3 m. There are provisions in the operating procedures to reduce the maximum reservoir operating level below El. 527.3 m in certain circumstances to ensure dam safety. The spillway gates must be operated to minimize the likelihood of the reservoir elevation exceeding the maximum allowable level.

There are five spillway gates at Seven Mile. The gates can be operated from the hoist house above the gates, the Seven Mile Control Room, or from the East Kootenay Control Centre (EKC) in Cranbrook. Normal operation is from EKC. Spill operations are normally directed from BC Hydro's System Control Centre in the Lower Mainland, except in the case of emergencies when independent action may be taken by EKC to safeguard the plant.

A multi-stage automatic emergency spillway control scheme is in service should supervisory control of the plant be lost for any reason. The system uses three types of sensors to detect reservoir level. When any two of the three sensors detect a rise in reservoir elevation to any trigger level, an automatic gate operation is initiated. Failure of one level sensing device at each level will not result in failure of the automatic control scheme. The initial trigger level for operation of the first automatic gate operation is El. 527.46 m.

2.6.4 Ramping Rates

(a) Powerplant Discharges

The ramping rates for the powerplant between zero discharge and maximum discharge are governed by the capability of the powerplant to respond to the needs of the electrical system. The powerplant can ramp up from zero output to full output in under 10 minutes, and back down in a similar time frame. In practice, the minute-to-minute and hour-to-hour variations in electrical demand usually result in a more gradual rate of increase/decrease in output.

In an emergency, (for example, the entire load on the plant is instantaneously lost due to a sudden transmission line outage), the plant would automatically shut down for protection of the plant and for safety reasons, and the plant could physically go from full discharge to zero discharge in approximately 10 seconds.

(b) Spillway Discharges

The powered operating speed of the spillway gates is 1.8 ft/min. The time required to open the gates from the fully closed position to fully open is approximately 30 minutes.

In practice, the spillway is normally operated only when the required discharge at the Seven Mile project is greater than the turbine capacity. This generally occurs during the freshet period, and spillway discharge ramping rates then closely approximate the natural variations of the river hydrograph.

2.6.5 Flushing Flows

As noted above, Seven Mile Reservoir has limited storage capacity (sufficient only for daily storage) and must pass whatever flows are received from upstream on an average daily basis. As such, Seven Mile does not have the capability for independently providing flushing flows.

2.6.6 Spillway Gate Operations/Ramping Rates/Flushing Flows

BC Hydro must comply with various regulations and standards relating to spillway gate operations/ramping rates and flushing flows. Adding the extra unit at Seven Mile will not change the way it is operated as these regulations will still have to be followed.

2.6.7 Operations of Storage Works

The storage water licence specifies the following reservoir water levels and storage capacity:

Operating Levels[1]

- maximum normal level 527.3 m
- minimum operating level 515.0 m

Levels[2] under Unusual Circumstances / Emergency Conditions

- surcharge level 527.9 m
- minimum water level 500.0 m

Storage Capacity: 36 863 acre feet (45.5 m^3 x 10^6 m^3)

In addition, correspondence between the Comptroller and BC Hydro has established the following reservoir fluctuation limits:

Reservoir Fluctuation

Summer Recreational Period (1 June - 31 August):

- 4 m maximum daily fluctuation[3]
- 0.6 m per hour maximum drawdown/fill rate

Remainder of the Year (1 September - 31 May)

- 6 m maximum daily fluctuation
- 1.2 m per hour maximum drawdown/fill rate

The reservoir operating level may fluctuate throughout the year between the operating levels authorized in the licence as water is alternately taken into storage and released from storage in response to continually changing rates of reservoir inflow and outflow. The cumulative volume of water taken into storage is unlimited with respect to time. During unusual or emergency conditions, the

---

[1] Measured in the forebay at the dam.

[2] During maintenance of the works or under severe flood conditions.

[3] In some years, BC Hydro has requested and received permission from the Comptroller of Water Rights for a 5 m maximum daily fluctuation limit for the purpose of reducing spill at Seven Mile at Waneta.

water stored between the maximum normal level and the surcharge level, or between the minimum operating level and the minimum water level, is not considered part of the storage capacity authorized under the storage licence.

Historically, the Seven Mile operating regime has resulted in daily fluctuations of Seven Mile reservoir which are less than 5.0 m for 95% of the time during the year. Based on the 1993 record, the reservoir level fluctuates within the top metre of the maximum normal level for about 23% of the year. Reservoir fluctuations for a typical year (1991) are shown in Figure 2-5. The installation of Unit 4 at Seven Mile will not change this.

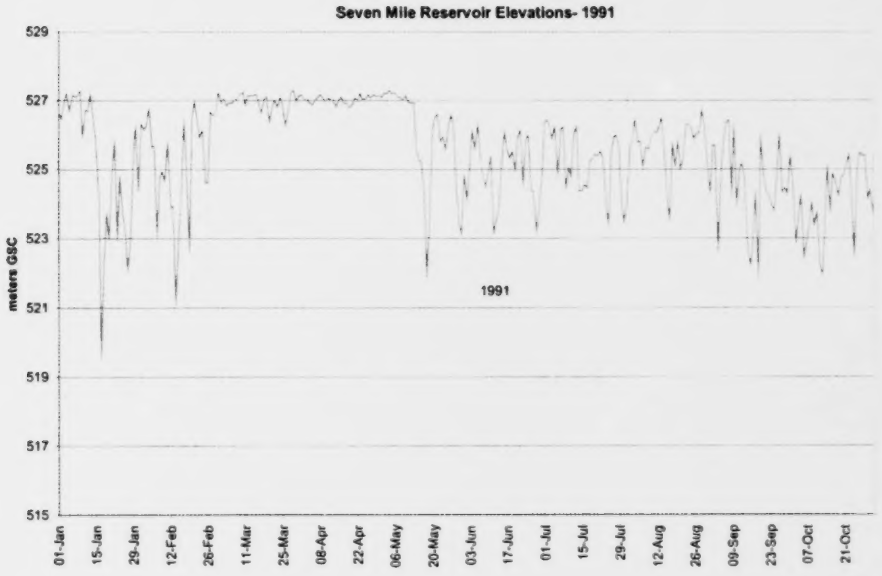

Figure 2-5 Seven Mile Reservoir Elevations - 1991

3 THE CONSULTATION PROCESS

3.1 Introduction

The Water Use Planning process for the Seven Mile Dam differs from most current Water Use Plan processes in that some of the Water Use Plan activities for the Seven Mile Dam predate the creation of the provincial guidelines for Water Use Planning in British Columbia.

Public consultation around operations of the Seven Mile Dam began in the late 1980s with the initiation of planning for the addition of the fourth generating unit. Consultation continued up until late 1996 when a draft Water Use Plan was written by BC Hydro, outlining its intended operations for the facility. From late 1996 to June 1998, the Seven Mile Water Use Plan underwent several revisions, both to address points raised by those involved in the review process [Fisheries and Oceans Canada (DFO), Ministry of Environmental Lands and Parks (MELP)[1], Ministry of Employment and Investment (MEI), and Canadian Columbia River Intertribal Fisheries Council(CCRIFC)] and to keep abreast with the then emerging provincial Water Use Plan guidelines.

By June 1999, several parties (DFO, MELP, CCRIFC) had pointed out that the consultative process to date had addressed the incremental impact of adding a fourth unit to the Seven Mile Generating facilities, but that the Water Use Plan had not addressed the overall operations of the Seven Mile Dam.

An interagency meeting (19 July 2000) consisting of BC Hydro, MELP, DFO, and CCRIFC reviewed these concerns and concluded that additional consultation was needed regarding operations of the Seven Mile Dam prior to resubmitting the Water Use Plan. In particular, this group agreed that:

- A limited number of meetings should be devoted to exploring and evaluating additional operational options (one additional meeting was suggested);
- More discussion would be devoted to exploring reservoir operations including large, fast drawdowns of the reservoir;
- Further public consultation was not necessary. Rather, these discussions would involve only the regulatory agencies and First Nations, and would be technical in nature;

[1] The Ministry of Environment, Lands, and Parks (MELP) was reorganized in 2001 into the Ministry of Water, Land and Air Protection and the Ministry of Sustainable Resource Management.

- The scope of these discussions would be limited to Canadian operations, and would not be designed as a strategic process to influence transboundary concerns.

- Operational alternatives would be created with the understanding that generation with four units is the new status quo at the facilities.

This document outlines the additional consultation recommended by the interagency group in July 2000. These additional meetings involved twelve people representing a range of agencies that had interests in impacts on power generation and on fish. This additional consultative process extended from December 2000 to January 2002 and included four meetings to work through the steps outlined in the Water Use Plan Guidelines. The consultation undertaken by BC Hydro from 1989 to 1999 is summarized in Appendix G (Draft Consultation Report of the Seven Mile Dam and Generating Station Water Use Plan).

3.2 Committee Composition

Table 3-1 shows the list of individuals on the committee reviewing operations of Seven Mile Dam to assist in creating operating recommendations for the Seven Mile Water Use Plan.

Table 3-1 List of Committee Members

Member	Affiliation
Gary Birch	BC Hydro
Hugh Smith	BC Hydro
Steve Mcadam	WLAP
Dan Sneep[2]	DFO
Tola Coopper	DFO
Mark Tiley	CCRIFC
Graham Fenwick	BC Hydro
Dave Wilson	BC Hydro
Basil Stumborg (facilitating)	BC Hydro
Daryl Fields[1] (facilitating)	BC Hydro
Bill Green[2]	CCRIFC
Jay Hammond[1,2]	WLAP

1. These individuals did not participate in the final meetings where trade-offs were considered.
2. Had left their respective agencies before the final version of the consultative report had been circulated.

3.3 Chronology of the Committee's Process

The committee reviewing the operations of the Seven Mile Dam for the Seven Mile Water Use Plan met on four occasions: 1 December 2000;

13-14 September 2001; 29, 30 October 2001; and 16 January 2002. The first three meetings were held at the BC Hydro offices in Castlegar, and the last meeting was held in the BC Hydro offices in Burnaby.

3.4 Scoping of Issues

At the initial meeting of the committee, a number of issues were raised about the overall impacts of operations. This list was then split into three categories:

Priority 1: a key issue that will be used to determine operating alternatives.

Priority 2: an issue that may influence operating alternatives, but only opportunistically (i.e. as refinements of alternatives are determined by key issues).

Priority 3: an issue that will not be used to define operating alternatives.

Table 3-2 Prioritization of Fish-based Issues and Concerns

Priority 1
Seven Mile Tailwater Fish Habitat
Waneta Downstream White Sturgeon Habitat
Waneta Downstream TGP (Total Gas Pressure) impacts
Entrainment of Bull Trout through Seven Mile Dam
Seven Mile Downstream Stranding
Priority 2
Seven Mile Spilling Impacts on TGP
Seven Mile Riparian Habitats in Reservoir
Seven Mile Reservoir Littoral Habitat
Waneta Reservoir Littoral Habitat
Waneta Downstream Littoral Habitat
Priority 3
Seven Mile TGP Issues from Synch-condense Operations
Seven Mile Leaching of Mine Tailings in the Reservoir
Seven Mile Reservoir Erosion
Seven Mile Reservoir Tributary Habitat
Seven Mile Tailwater Bank Sloughing
Waneta Reservoir Ripariian Habitat
Waneta Reservoir Fish Stranding
Waneta Reservoir Tributary Habitat
Waneta Reservoir Erosion

These issues and their priorities formed the basis of the discussions over the four meetings of this committee. The extent and nature of these issues, and their relation to Seven Mile operations, was determined based on reviews of existing information and/or field investigations. Their role in determining alternatives was refined through further discussions. Those items classified as priority three were dropped from further discussion.

Several issues not related to fish interests were also raised. These are summarized in Table 3-3.

Table 3-3 Non-Fish Objectives

Objective	Issue	Comment
Recreation	Boat Launch	Waneta and Seven Mile Reservoirs
	Beach area and swimming access	Seven Mile Reservoir
	Angling	Seven Mile Reservoir
Wildlife	White-tailed deer	Reservoir Operations
	Migratory Birds	
	Painted Turtle	
	Rubber Boa	
	Bats	
	Osprey	
First Nations (non-fish)	Heritage Resources	No concerns brought forward (see Section 4.5)

4 SETTING OBJECTIVES FOR OPERATIONS AT SEVEN MILE DAM

4.1 Maximize Revenues through Power Generation

BC Hydro currently operates the Seven Mile Dam to maximize the revenues obtained through power generation, subject to physical and regulatory constraints. Several constraints were suggested for removal, which could increase the generation of revenues through operations. As well, several additional constraints were considered, which presumably would decrease the generation of power revenues.

All other things being equal, alternatives with higher revenue generation would be preferred. And so, power revenues were selected as one of the criteria by which committee members would choose among alternatives.

4.2 Maximize White Sturgeon Habitat below Waneta Dam

Total Gas Pressure (TGP) Impacts

The turbine capacity at Seven Mile Dam, with the addition of its fourth unit, exceeds the turbine capacity of Waneta Dam. Consequently, it is possible that the maximization of revenue generation at the Seven Mile Dam may result in spilling at Waneta.

Spills at Waneta Dam increase Total Gas Pressure (TGP) downstream, threatening the suitability of this area for white sturgeon. All things being equal, the committee would choose alternatives that decrease TGP production at Waneta dam. Therefore, TGP production at Waneta Dam was selected as a possible performance measure which committee members would use to help them choose among alternatives.

Temperature in the Waneta Eddy

Changes in flows from Waneta dam are a partial function of flow releases from the Seven Mile Dam. These flow changes impact the mixture of water temperatures at the confluence of the Pend d'Oreille and Columbia Rivers. The confluence is a white sturgeon spawning area, and it is assumed that fluctuations in temperatures negatively impact these fish.

All things being equal, the committee would prefer less temperature fluctuation below Waneta Dam, and so this was selected as a criterion to help the committee choose among alternatives.

4.3 Minimize Negative Impacts to Fish below Seven Mile Dam

Stranding From Ramping Down

Currently there are no restrictions on the ramping rate at the Seven Mile Dam facility. In particular, flows fluctuate rapidly between zero and 8000 cfs due to the design of the plant. As flows drop quickly, fish can become isolated and stranded in pools or in the substrate interstices. Over time, these fish could die from predation or asphyxiation.

The committee decided that they would prefer to choose operations that decreased the incidence of stranding below the dam. As a result, this was introduced as a criterion that would help committee members choose between alternatives.

Deterioration of Habitat from Ramping up and High Velocities.

The aquatic habitat from the Seven Mile tailrace to the Waneta Reservoir is an area that can be subject to large swings in flows due to operations of the Seven Mile Dam. DFO felt that this habitat may be suitable for whitefish spawning and incubation, and so protecting or enhancing this habitat became one of the potential objectives.

4.4 Minimize the Risk of Entrainment of Bull Trout through Seven Mile Dam

Bull trout are a blue listed species that exist in low numbers in the Seven Mile Reservoir. It is hypothesized that sub-adult bull trout move out of the Salmo River and enter the reservoir.

On occasion, BC Hydro draws the reservoir down quickly. The definition of these "deep drawdowns" was not fully defined by the committee. However, historical reservoir elevations show that drawdowns of roughly 6 m over a few days have happened periodically since 1984. This decreased volume of the reservoir may increase the risk of bull trout entrainment through the dam.

Bull trout may also be entrained through the dam during operations that are not classified as "deep drawdowns", i.e. more limited drawdown, freshet, or general operations.

The committee recognized the need to evaluate the risk of entrainment of bull trout. However, given the lack of good information about this issue, and given the lack of flexibility on this system, no alternatives were developed to address this issue. This question around the entrainment of bull trout was identified as key uncertainty and is revisited in Section 8.2 as a request for monitoring.

4.5 Objectives Identified but not Pursued

Wildlife Interests

Based on discussions within the group and local knowledge obtained through discussions between the WLAP representative and outside experts, the committee determined that there was not enough flexibility in Seven Mile Dam operations to significantly impact wildlife interests. As a result, objectives and performance measures for these interests were not developed.

Recreational Interests

Based on discussions within the group and local knowledge obtained through discussions between BC Hydro and outside experts, the committee determined that there was not enough flexibility in Seven Mile Dam operations to significantly impact recreational interests. As a result, objectives and performance measures for these interests were not developed.

Heritage Interests

Impacts on heritage sites around the reservoir were raised at initial discussions. An inventory of archaeological sites was completed with the conclusion that sites were not present in the Seven Mile Reservoir[1]. No additional information was brought forward during committee discussions, so the development of objectives and performance measures for heritage sites around the reservoir was not pursued.

Littoral Habitat Upstream and Downstream from Waneta

Discussions regarding the operations at the Seven Mile Dam highlighted the lack of flexibility and constraints for BC Hydro in examining potential operational changes. In particular, there was little opportunity to change operations to address concerns in the downstream (Waneta) reservoir. As a result, the Priority 2 and 3 Objectives for the Waneta Reservoir were not pursued. This group of objectives not pursued includes Waneta Reservoir and downstream littoral habitat.

Tributary Access in Reservoir

Upon review of existing knowledge of tributary access issues and review of additional information collected by Mark Tiley (CCRIFC), tributary access around the reservoir was deemed a low priority in terms of generating alternative

[1] Communication from Thomas Munson of the Ktunaxa Nation Treaty Council following the consultative process, in communication with Mark Tiley of CCRIFC and Wayne Choquette, reiterated that there is few, if any, cultural/archaeological concerns in the reservoir (email communication, 14 June 2002).

uses of water and in terms of assisting in choices between alternatives. See Appendix C for the CCRIFC report on tributary access.

Reservoir productivity

Reservoir productivity is used loosely here to describe the ability of the reservoir to sustain fish in their various life stages. These discussions covered both the productivity of the littoral zone as well as the presence of contaminants from mine sites around the reservoir.

Reservoir productivity was raised initially as a key driver in determining alternatives and for selecting among alternatives. However, further examination led to the conclusion that changes to reservoir operations would not affect the rate of metals leaching into the reservoir which could affect reservoir productivity. Secondly, while it was suggested that decreasing the littoral productivity of the reservoir may reduce habitat for exotic fish species, it was agreed that the introduction of exotic species into the reservoir from American reservoirs upstream was an ongoing process that could not be addressed adequately within this Water Use Plan. As a result, the group agreed that no alternatives would be generated to address this interest. Moreover, since no significant changes to reservoir operations were anticipated, no performance measures were developed for reservoir productivity that would help the group choose among operations.

5 DATA COLLECTION

A number of activities were undertaken within the course of this process to further inform discussion around certain issues and concerns. The issues addressed, the activities undertaken, the reporting agency, and the location of this information is listed in Table 5-1.

Table 5-1 Data Collection Activities

Issue	Activity	Reporting Agency	Key Lessons	Location of Output
Fish habitat below Seven Mile Dam	A float of the river was done at minimum flows, noting substrate composition and suitability for spawning and incubation	DFO	Area inhospitable to fish for spawning and incubation, but some areas that pose stranding risk.	Appendix A
Fish stranding below Seven Mile Dam	A helicopter flight over the river was undertaken with videotaping and photos of potential stranding areas taken at several flow levels	BC Hydro	Three areas that pose stranding risk	BC Hydro (2001) Seven Mile Tailrace Stranding Assessment (Bob Westcott).
White sturgeon	Input was collected on several occasions from the White sturgeon Recovery Team	WLAP	Status quo operations cannot be improved upon, given current flexibility and knowledge levels	See meeting minutes
Leaching of Mine Tailings	Remac mine contaminant reconnaissance report (Thurber, 1989) was reviewed	DFO	Leaching of contaminants into the reservoir could not be addressed through operations	
Tributary Access	Input was received in the form of a report regarding tributary access issues in the Seven Mile Dam reservoir	CCRIFC	Tributary access is not an issue of great concern when designing water use alternatives	Appendix C
Revenue Generation	Some rough modelling was done of the loss of power revenues from providing 8000 cfs min flows	BC Hydro	Minimum flow alternatives are very expensive and cannot be maintained at all times	The financial results are presented in Section 7

6 OPERATING ALTERNATIVES

After prioritizing the operational issues and discussing the limitations to the flexibility of the dam operations, the committee created a list of six operating alternatives for Seven Mile Dam. These alternatives are described below, along with a brief description of their background.

Alternative 1 - Status Quo Operations

The committee considered status quo to be the existing dam operation with four units in place, subject to the current operating restrictions. See Section 2.6 of this report for a more detailed and complete description of these restrictions.

Generally speaking, "Status Quo" means that the only restrictions on operations are those:

- governing efforts to distribute discharges to minimize spilling at the Waneta facilities to protect white sturgeon spawning/incubation downstream of Waneta;
- limiting the drawdown of the reservoir during the summer recreational period to 4 m (1 June to 31 August), with a 0.6 m per hour drawdown/fill rate to maintain recreational opportunities in the reservoir;
- limiting the drawdown of the reservoir during the remainder of the year to 6 m, with a 1.2 m per hour maximum drawdown/fill rate to prevent sloughage of unstable banks around the reservoir.

Alternative 2 - Minimum flow of 8000 cfs from 1 November to 14 April

Flows below the Seven Mile Dam fluctuate widely on a daily basis. In particular, because of design characteristics, flows decrease almost instantaneously when the units ramp down from 8000 cfs to zero (or leakage) flows. These sudden drops in flows pose the potential to strand fish in small pools or substrate interstices. Fish stranded will be stressed and may die from predation or asphyxiation.

By maintaining 8000 cfs flows below the dam, the risk of stranding fish in these pools may be reduced.

Alternative 3 - Reduce Rampdown Rates for Flows Between 12 000 cfs and 8000 cfs

Flows below the Seven Mile Dam fluctuate widely on a daily basis. These sudden drops in flows pose the potential to strand fish in small pools or substrate interstices. Fish stranded there will be stressed and may die from predation or

asphyxiation. Reducing the ramp down rate will allow fish to move out of potential stranding areas.

Alternative 4 - Status Quo Operations, but with Restrictions that Limit Spilling at Waneta Dam in August Removed

The months of June, July and August carry increased constraints on Seven Mile Operations in that they force BC Hydro to make best efforts to avoid flows that lead to spilling at Waneta Dam. However, similar constraints at Waneta are only for June and July.

If the August constraint is not required to protect white sturgeon spawning, incubation or rearing, then the removal of this restriction may lead to increased revenue generation for BC Hydro.

Alternative 5 - White Sturgeon Friendly Flow

Restrictions at Waneta Dam require 10 000 cfs flows during the day and 5000 cfs during the night to benefit white sturgeon spawning and incubation downstream of Waneta Dam. The committee requested an examination of an alternative in which flows from Seven Mile were designed to extend this higher flow period for a greater portion of each 24 hour period, and reduce the portion of each 24 hour period spent at the lower flows.

Alternative 6 - Status Quo Operations, but with the 6 m Drawdown Restriction Outside of the Summer Removed

A 6 m drawdown limit had been imposed on operations of the Seven Mile reservoir. Part of the original motivation for this limit was that some bank instability had been predicted. However, since the imposition of this restriction, this concern has subsided and the belief among the committee was that this restriction may not be needed.

If the 6 m drawdown was removed, this would increase revenue generation through Seven Mile operations.

7 CARRYING OUT TRADE-OFFS AMONG OPERATIONS

7.1 Method for Carrying out Trade-offs

Since the analysis of these alternatives was done at a high level, no performance measures were used to construct an "alternatives by consequences" table. Rather, each alternative was considered on its own merit, refined or rejected.

Alternatives 2 and 3 - Revised with Physical Changes in Lieu of Changes in Flows

It was recognized by the committee that imposing ramping restrictions or minimum flow restrictions on the operations of the Seven Mile facilities would be very costly. BC Hydro estimated that the minimum flow restrictions alone would result in losses of $800,000 annually in foregone generation revenues at Seven Mile Dam, and an additional $860,000 in losses of generation revenues at Waneta. These losses exclude the impacts of headlosses and do not take into account that in some months these minimum flows could not be maintained.

As well, data gathered during this process suggested that the habitat below the dam was inhospitable to whitefish for spawning and incubation. As a result, limiting the exposure of these lifestages to high velocities ceased to be an issue for this group.

The committee suggested that physical changes to the river downstream of the Seven Mile dam might be considered as a less expensive, more effective alternative to minimum flows and ramping restrictions. In particular, there are three small areas below the dam that are potential stranding sites. Recontouring these areas may provide a means to avoid this stranding risk without forgoing significant revenues.

This alternative was refined to one that would adopt the status quo restrictions on Seven Mile operations, and would recontour the three areas below the dam that could pose stranding risks for fish in pools (but not interstitial stranding). Further field investigations are planned both before and after the freshet in 2002 to determine whether stranding is an issue. An upper bound contingency estimate on these costs totals $50,000. This includes all costs from the design and survey stage to the completion of the physical work.

Alternative 4 - Status Quo Operations, but with Restrictions that Limit Spilling at Waneta Dam in August Removed - Dropped

Input from DFO, which imposed these restrictions as a condition of the Seven Mile Unit 4 authorization, and the Sturgeon Recovery Team suggested that the limits placed on Seven Mile Operations in August were important both for

maintaining the appropriate temperature conditions below Waneta Dam and also for reducing the incidence of spilling at Waneta Dam which causes TGP. In response to the committee's inquiries, DFO and the Sturgeon Recovery Team advised against removing the August restrictions on Seven Mile operations, saying that there was not enough information about the impacts of such a change to warrant it.

The removal of August restrictions on Seven Mile operations would have created the potential for gains in revenue at the possible expense of white sturgeon downstream of Waneta Dam. The committee decided not to pursue this alternative. Implicit in this decision is that the (unmeasured) financial gains from removing this restriction are outweighed by the (unmeasured) risks to white sturgeon downstream of Waneta Dam.

Alternative 5 - White Sturgeon Friendly Flow - Dropped

Further discussion around BC Hydro's ability to control flows past the Seven Mile Dam (e.g., at Waneta Dam) led to the conclusion that there were no alternative operations at Seven Mile Dam that could deliver increased benefits to white sturgeon downstream of Waneta. This is the result both of the current limited flexibility in operations at Seven Mile Dam and the likelihood that currently, spawning is not limiting recruitment for this species in this area.

Since without additional restrictions, the alternative that is most friendly to the white sturgeon is the Status Quo, this alternative was dropped by the committee.

Alternative 6 - Status Quo Operations, but with the 6 m drawdown restriction outside of the summer removed - dropped

It was recognized by the committee that this change in constraints on reservoir operations may have benefits across a wide variety of impacts. In particular, it may increase revenues and increase the ability to reduce spilling at Waneta Dam. However, the removal of this constraint would require input from the director of dam safety, members of the public that use the reservoir outside of the summer months, and geotechnical engineers. This level of involvement could not be fit into the timeline of this Water Use Plan.

However, the committee did agree that, given the multiple objectives that could be addressed through increasing this drawdown, this topic should be explored in more detail when this Water Use Plan is reviewed in the future.

7.2 Final Trade-off Discussion

Given that Alternatives 4, 5 and 6 were dropped, the committee faced a choice between Status Quo operations and the revision of Alternatives 2 and 3. However, since Alternatives 2 and 3 were revised to be Status Quo operations with physical changes in lieu of operational changes, the choice before the

committee was whether the cost of this contouring was worth the reduction in risk to stranding for fish immediately downstream of the Seven Mile Dam.

The group agreed that the areas highlighted posed a risk for stranding fish when water levels dropped quickly. The group also agreed that the river might support enough fish so that this risk of stranding justified spending the money on this recontouring project. As a result, the group endorsed the concept of contouring the riverbed to reduce the risk of stranding.

However, one outstanding data gap was whether fish were actually getting stranded in these areas. While the cost of the recontouring project was thought to be relatively low, the group did not want to recommend this approach if fish were not being stranded. This outstanding uncertainty is addressed in Section 8.

8 MONITORING PLANS

Two key uncertainties were raised through this process: the risk of stranding of fish downstream of the dam and the magnitude of the risk of entraining bull trout through the dam. These uncertainties will be described in more detail below, along with the monitoring programs developed to address these uncertainties.

The first monitoring plan, addressing the risk of stranding to fish downstream, will be funded by BC Hydro. As a result, this monitoring activity is not presented as a request to the Water Comptroller, and less detail is provided.

8.1 Monitoring to Assess the Risk of Stranding of Fish Downstream of Seven Mile Dam

Three specific areas were identified between the Seven Mile Dam and the Waneta Reservoir at low pool that posed a possible stranding risk to fish when flows are dropped quickly. To ascertain whether a stranding risk exists, two field visits are planned for 2002: In May before the freshet, and in August, post-freshet. Electroshocking and manual searches through the interstitial spaces will estimate the number of fish stranded. The costs for this are expected to be $10,000, which BC Hydro committed to funding.

Once this data is collected, BC Hydro will communicate the results to the appropriate governments and their agencies. Based on these discussions, a decision will be made by BC Hydro, in consultation with the agencies represented in this committee, about whether recontouring of the riverbed is required. If recontouring is needed, this would be a physical change in lieu of an operational change, and the committee expected that this would be funded in the same way other alternatives are funded under Water Use Planning.

8.2 Monitoring to Assess the Risk of Entrainment of Bull Trout

Bull trout are a highly valued sport fish species that are blue listed (considered vulnerable in British Columbia.). Some concern was expressed within the committee that large, rapid drawdowns of the reservoir might increase the risk of entraining bull trout through the dam.

By radio tagging bull trout in the Salmo River, and then monitoring fish that may move into the reservoir and through the dam, a link may be established between operations and bull trout entrainment if sufficient numbers of fish are encountered to define operational effects. A more complete description of this study proposal can be found in Appendix B.

List the Null and Competing Hypotheses

The group considered two competing hypotheses around the entrainment of bull trout through dam operations:

H_0: Rate of entrainment of bull trout is independent of operational changes at the Seven Mile facilities.

H_1: Rate of entrainment of bull trout can be altered through operational changes at the dam.

The group diverged in its assessment of the likelihood of these hypotheses. BC Hydro felt that entrainment was most likely not a significant issue and was probably not related to operations, and they felt that study results by RL & L supported this view. CCRIFC and other members of the committee felt that the possibility that operations were having an impact on entrainment was large enough that this issue had to be addressed through monitoring.

Question No. 1 - Would the realization of any of the alternative hypotheses change the decision of the committee?

Answer No. 1 - BC Hydro identified three reasons for deep drawdowns within the reservoir:

1. to capture increased inflows from Boundary Dam in order to avoid spilling at Seven Mile Dam and Waneta Dam,
2. in response to market opportunities, most likely during the winter months, and
3. to allow for maintenance.

The group agreed that operational changes to address bull trout entrainment were reasonable only if they occurred as a result of maintenance that could be easily deferred to months when entrainment was not an issue. This was presumed to be the summer months when warm reservoir temperatures are inhospitable to bull trout.

If bull trout entrainment was found to be linked to

1. maintenance that was not easy to reschedule,
2. capturing increases in inflows from Boundary Dam to avoid spilling, or
3. in response to market opportunities,

then limiting the drawdown of the reservoir would come at a large cost (either financial and/or to downstream fish interests).

In lieu of expensive operational changes to address bull trout entrainment, it was suggested that behavioural techniques could be used to keep bull trout away from the intakes. These might include flashing strobe lights. If significant levels of

entrainment were found that could be linked to operations that could be changed, and if these aversion techniques were cost efficient, then most members of the committee felt that these physical changes in lieu of operational changes would be justified.

Question No. 2 - Does the monitoring plan have the ability to distinguish among the hypotheses listed?

Answer No. 2 - This proposed monitoring plan will give one of two answers: "no" or "maybe".

The study will tag 100 fish over 5 years. If the fish (which are tagged in the Salmo River) spend little or no time in the reservoir, then entrainment of Salmo River bull trout will be shown to be a non-issue.

However, given the low numbers of bull trout being tagged, previous studies, and the low numbers of bull trout expected to enter the reservoir, linking entrainment to operational activities will be difficult. For example, if some bull trout are entrained at various times during the year, it will be difficult to say with confidence whether entrainment is or is not linked to maintenance activities that are easily rescheduled.

Question No. 3 - State the timeframe in which this information is being used.

Answer No. 3 - This data will be collected over a time frame of not greater than 5 years. This data will be used to help decide amongst operations when the Water Use Plan is reviewed. The review period is discussed in Section 9.

Question No. 4 - Is there a less expensive way to learn these lessons than this proposed study?

Answer No. 4 - The upper bound estimate on costs for this monitoring program is roughly $30,000 for each of five years after this is approved by the Comptroller of Water Rights. The group agreed that this technique of tagging and radiomonitoring is the least expensive way to assess the entrainment question. Discussions showed that this approach is substantially less expensive and more informative than other methods used at other BC Hydro facilities.

Question No. 5 - Is there a less expensive way to obtain this information through ongoing data collection at other Water Use Plans?

Answer No. 5 - The group agreed that this is a site-specific question, and so no studies from other locations can be applied here.

The group then agreed that this proposal will be put forward to the Comptroller of Water Rights, along with the recommendations of dam operations.

9 REVIEW PERIODS

The implementation of this Water Use Plan involves several instances where decisions will be made based on information collected. The timeframe of these decision points is listed below:

Decision 1 - is the stranding of fish below Seven Mile Dam a significant issue?

In the spring and late summer of 2002[1], studies will be carried out by BC Hydro to determine whether stranding in the pools below the Seven Mile Dam is an issue. If stranding is not an issue then no recontouring of the riverbed will take place and the Comptroller of Water Rights will be notified.

Decision 2 - According to Step 13 of the Water Use Plan Guidelines, emergent water use issues can trigger the review of a Water Use Plan. The committee recommended that this Water Use Plan be reviewed when the earliest of the following four events occurs:

1. Imminent, significant changes to upstream facilities or operations. It is anticipated that this includes, but is not limited to, physical changes to Boundary Dam and FERC relicensing of that facility;
2. Imminent, significant changes to downstream facilities. It is anticipated that this includes, but is not limited to, an expansion of the Waneta Dam facilities;
3. Emergent water use issues. It is expected that this may include, but not be limited to, the establishment of a strong link between bull trout entrainment and dam operations at the end of the 5 year monitoring program, or new information making a strong link between white sturgeon and dam operations;
4. Ten years after this Water Use Plan is accepted by the Comptroller of Water Rights

[1] In his review of this report in January 2003, Hugh Smith (BC Hydro) noted that these studies were initiated in 2002 and that further studies to complete the evaluation will be carried out in 2003.

10 SUMMARY OF RECOMMENDATIONS

The committee reviewing operations of the Seven Mile Dam made the following recommendations:

- This committee recommends that BC Hydro continue operating the Seven Mile facilities subject to the current set of constraints. This committee recommends no additional constraints, and does not recommend the removal of any of the current constraints. A complete description of these can be found in Section 2.6.

- In lieu of adopting ramping rates and minimum flows, the committee recommends that the three areas identified as potential risks for stranding during rapid flow decreases be recontoured to reduce the risk of stranding. These areas are described in more detail in the BC Hydro report, "Seven Mile Tailrace Fish Stranding Assessment" (2001, Bob Westcott).

- To ensure that this recontouring of the riverbed is a prudent expenditure, these sites will be subject to monitoring over the course of the next year by BC Hydro. If few fish are stranded, then this committee recommends that the recontouring project not be conducted. And if stranding is determined to be a significant issue, then it is recommended that a recontouring of these areas take place to reduce this risk, at a cost of no more than $50,000. This recommendation will be made by BC Hydro, in consultation with the parties involved in this process (DFO, WLAP, and CCRIFC).

- To ensure that changes to operations to benefit bull trout were not overlooked, the committee recommends that a monitoring program assessing the links between bull trout entrainment and operations of the Seven Mile Facilities be undertaken. The proposed monitoring program can be found in more detail in Appendix B.

- The committee recommends that this Water Use Plan be reviewed within in a time frame of no less than 10 years after it is approved. A review of this Water Use Plan will be triggered by the earliest of the following events:

    - Imminent, significant changes to upstream facilities or operations. It is anticipated that this includes, but is not limited to, physical changes to Boundary Dam and FERC relicensing of that facility.

- Imminent, significant changes to downstream facilities. It is anticipated that this includes, but is not limited to, an expansion of the Waneta facilities.

- Emergent water use issues. It is expected that this may include, but not be limited to, the establishment of a strong link between bull trout entrainment and dam operations at the end of the five year monitoring program, or new information making a strong link between white sturgeon and dam operations.

APPENDIX A: DFO REPORT ON FISH HABITAT BELOW SEVEN MILE DAM

Memo: Habitat Assessment of the Pend d'Oreille River Downstream of Seven Mile Dam
From : DFO, Dan Sneep
Date: November 23, 2001
To: Seven Mile WUP Committee

The following is a summary of the results of a snorkel survey conducted in the Pend d'Oreille River downstream of Seven Mile Dam. The survey was intended to provide information for the development of the Water Use Plan for the Seven Mile facility, specifically to evaluate the viability of providing a minimum flow to support fish populations in the riverine section downstream of the dam. Use of the area by mountain whitefish, rainbow trout, and cutthroat trout has previously been documented. The objective of the survey was to conduct a qualititative visual assessment of salmonid habitat availability and suitability at a minimum release from the dam.

The survey was conducted from approximately 1100 h to 1430 h on 26 October 2001. The dam was releasing a flow of 225 m^3/s (8000 ft^3/s) from Unit 2 for the duration of the survey. This discharge represents the minimum flow available from the Seven Mile powerhouse. The assessment was conducted by snorkeling both banks of the river downstream of the dam, from the tailrace pool to the upper end of Waneta Reservoir, a distance of approximately 650 m. Observations of hydraulic type and substrate condition were recorded on a 1:4000 air photo (Figure 1).

Despite somewhat limited visibility (i.e., approximately 3 m) due to turbidity, extensive observations of nearshore and midchannel habitats were made during the survey. Habitat complexity in the survey area was generally low. The section was dominated by deep run habitats, with the exception of a set of rapids located approximately 250 m downstream of the dam, and a large eddy along the right bank below the rapids. The channel in this section was largely defined by relatively steep canyon walls, and as such littoral area was quite limited and the midchannel appeared to be quite deep (i.e., the bottom was beyond visual range).

Substrates in the survey section consisted primarily of bedrock and large (i.e., >1 m) boulders. Some cobbles, gravels, and sand were observed in eddies and between large boulders. The low abundance of these smaller substrates suggests that they are largely transported out of the area during spill events. All of the substrates observed were highly angular in form, suggesting that they were not historic river bed materials but were possibly generated by dam excavation and construction activities. One adult mountain whitefish was observed during the survey, over a pocket of cobble and gravel in the midchannel downstream of the rapid section. This observation was not considered indicative of fish use of the area, however, as use may have been disrupted by the fluctuation in flows that preceded the survey.

The littoral habitats observed in the survey area consisted of a large cobble bar and gravel beach area on the right bank, approximately 300 m downstream of the dam (Figures 2 and 3), a small cobble island and backwater area along the left bank, about 550 m below the dam (Figure 4), and a gravel bar along the right bank, approximately 650 m downstream of the dam (Figure 5). The low velocities and relatively small substrates at these sites may make them suitable for fish, though the low gradient would likely result in extensive dewatering and potential fish stranding during reductions in flow.

In summary, the hydraulic and substrate conditions of the riverine section downstream of Seven Mile Dam indicate that this area does not provide suitable habitat for salmonids, even at a constant minimum release from the dam. The area appears to be subjected to extensive scour during spill events, which has affected substrate composition and channel morphology, and would also likely limit periphyton accrual and benthos production. Though the abundant large boulders in the area would presumably provide velocity refugia during high flow events, the resulting habitat conditions are considered insufficient to support salmonid feeding, spawning, and rearing.

While the results of this survey do not support the provision of a minimum flow for salmonids downstream of Seven Mile Dam, the potential for fish use of littoral areas that may be subjected to dewatering during flow reductions indicates that potential fish stranding associated with Seven Mile operations should be considered in the development of the Water Use Plan.

APPENDIX B: MONITORING REQUEST REGARDING BULL TROUT ENTRAINMENT THROUGH SEVEN MILE DAM

Subadult bull trout Life History, Distribution and Habitat Utilization in the Salmo River and Seven Mile Reservoir

1.1 Site Description

The study would be implemented in the Salmo River mainstem and include the Seven Mile Dam tail race on the Pend d'Oreille River. The Salmo River is located 12 kilometers southeast of Nelson. The Salmo River is a 5th order stream that flows in a southerly direction through the town of Salmo in the West Kootenays and confluences with the Pend d'Oreille River (Seven Mile Reservoir). The Salmo River supports the only significant bull trout habitat in the Pend d'Oreille watershed in Canada. The Salmo River drainage basin covers a total area of approximately 123 000 ha. The dominant biogeoclimatic zone at higher elevations is Englemann Spruce-Subalpine Fir. At lower elevations the biogeoclimatic zone is Cedar-Hemlock.

1.2 Executive Summary

This monitoring program was designed and put forward by CCRIFC on behalf of the committee in order to describe a recommended study design that will go forward to the Comptroller of Water Rights.

The study would determine the life history and population dynamics of the Salmo River subadult bull trout (two to five-year-old fish) through the use of radio telemetry and underwater observation techniques. Lotek manufactures the Nano tag, a radio transmitting tag that is small enough to be surgically implanted in subadult bull trout and is guaranteed to last for 316 days. The Nano tag was introduced approximately one year ago and has proven to be effective by other researchers. The data will identify habitat requirements, survival and mortality rate, distribution and abundance, extent and rate of entrainment through the Seven Mile Dam and determine the presence of an adfluvial bull trout population that may be subjected to significant mortality as a result of entrainment and high reservoir temperatures.

The study would need at least five years to adequately determine the factors limiting the recruitment of subadult bull trout into the adult population and to identify the existence of an adfluvial population that may be susceptible to entrainment downstream of Seven Mile Dam. At least five years would be required to encompass annual variations in snowpack and related discharge to assess the relationship between discharge volume, stream velocity and extent and speed of subadult bull trout downstream movement, number of bull trout entering the reservoir and the number of bull trout entrained and bull trout distribution in the Salmo River.

1.3 Issue

The Salmo River bull trout (*Salvelinus confluentus*) spawning population is estimated to number no more than 200 adults (Baxter, 1999). The bull trout is currently blue listed Province-wide by the Province of British Columbia (BC Conservation Data Centre). Earlier assessment of the Salmo River watershed suggested that habitat quality was not limiting to bull trout given the small adult population size (Baxter, 1999). bull trout harvest and possibly poaching was identified as a potential limitation to population recovery and led to the implementation of a moratorium on Bull trout harvest in the Salmo River watershed in 1999 (Hammond, personal communication). Mortality at the subadult life history stage may significantly affect bull trout recovery in the Salmo River watershed. An assessment of the life history of subadult bull trout, aged 2 to 5 years, in the Salmo River watershed is needed to identify the limiting factors affecting bull trout recruitment to reproductive age. Data on adult bull trout seasonal migration pattern, habitat utilization and habitat requirements are well represented in the literature (i.e. Baxter, 1999, 2001; Schwabe & Tiley, 2000; Stelfox, 1997; Swanberg, 1997) but relatively little data is available on subadult bull trout movement and detailed habitat requirements. Due to a lack of knowledge regarding subadult population dynamics and habitat requirements, conservation measures may only address the juvenile and adult life history stages.

Bull trout have evolved varied life history strategies, including *resident*, *fluvial*, *adfluvial* and *anadromous* forms (Bergdahl, 1998) that likely enhances the probability for the long-term survival of a given population. The twelve bull trout captured in Seven Mile reservoir in the years 1994, 1995, the majority of which were subadults (RL&L, 1995), represent either 1) a remnant population of *adfluvial* bull trout that migrate seasonally to the reservoir to rear or 2) *fluvial* and/or *resident* bull trout that were flushed into the reservoir possibly during spring high flow periods or storm events. The possibility exits that an *adfluvial* population, originating from *fluvial* Salmo River bull trout, developed in the Pend d'Oreille River following the construction of Waneta Dam, located near the Pend d'Oreille /Columbia River confluence, in 1954. Confirmation of the presence of an *adfluvial* bull trout may initiate changes in Seven Mile Dam operations as a component of the Seven Mile Water Use Plan or result in the installation of behavioural avoidance devices such as strobe lights in the Dam forebay that may reduce entrainment.

1.4 Objectives

The main objectives of the study would be to establish a better understanding of bull trout life history in the Salmo River system and to identify limiting factors affecting population recovery. By achieving the list of specific objectives listed below, the main objectives would be achieved.

- Monitor subadult bull trout seasonal migration in relation to stream temperature and discharge
- Identify high utilization areas and preferred habitats
- Quantify the mortality rate of tagged subadult bull trout resulting from natural causes
- Quantify the rate of illegal poaching of tagged subadult bull trout

- Determine the percentage of tagged subadult bull trout that enter Seven Mile Reservoir and return to the Salmo River
- Quantify the percentage of radio-tagged subadult bull trout entrained at Seven Mile Dam
- Determine the affects of high temperatures in the lower portion of the Salmo River mainstem during July and August

1.5 Activities/Techniques

The following description was developed by CCRIFC for the Seven Mile WUP committee. As a recommendation, it is subject to modification to allow for changes in personnel, property rights, technological advancements in radio telemetry and for other issues that would allow the intent of the recommendations to be achieved in more efficient and/or more effective ways.

Subadult bull trout selected for tagging would be captured throughout the Salmo River mainstem to obtain individuals that originated from most or all of the natal tributaries prior to spring freshet. Subadult bull trout would be captured by snorkelling at night with a dip net and possibly by angling. Weekly tracking by raft and/or foot will be conducted to monitor subaduit movements from early April to late October and monthly in the winter if weather permits.

4.5g Nano tags will be surgically implanted into subadult bull trout following the surgical procedure outlined in Baxter (2001). No mortality as a result of the implant surgery or internal tag in 1998 or 1999 was observed (Baxter, 1999). The Nano tags would be surgically implanted into 20 bull trout of at least 150g and between approximately 200millimeter (mm) and 300mm fork length (FL) for each year of the study.

A total of three radio tag receivers will be used. One portable receiver will be used to monitor bull trout movement in the Salmo River and Salmo River tributaries. There are five tributaries other than the Salmo River that flow into the reservoir and provide fish access under certain reservoir elevations (Tiley, personal observation), including Lomond Creek, Fraser Creek, Harcourt Creek, Limpid Creek and Nine Mile Creek, may provide refugia habitat when the reservoir exceeds 15 °C, the temperature above which likely limit bull trout distributions (Bonneau & Scarnecchia, 1996). If subadult bull trout enter the reservoir, these tributaries will also be tracked monthly. These tributaries, with the exception of Lomond Creek generally have impassable barriers within 1 km of the tributary mouth (RL&L, 1995;Tiley, personal observation) enabling all or most of these tributaries to be tracked within a day.

Field data collected along with the UTM coordinates of tagged fish will include date, time of day, temperature, qualitative details on habitat (i.e. habitat type, depth, percent cover, substrate, etc), presence and approximate size of other bull trout and other fish species, water clarity and flow conditions. Salmo River discharge data that is continually monitored will be correlated with fish movement and distribution. Temperature data loggers currently being deployed by Steve Arndt (Columbia Basin Fish and Wildlife Compensation Program) and augmented with Canadian Columbia River Inter-Tribal Fisheries Commission (CRIFC) temperature loggers, along with historical temperature data would be correlated against bull trout distribution and migratory behaviour.

Subadult movement will be correlated to Salmo River temperature to determine if high temperatures in the lower mainstem are acting as thermal barriers. Temperature data loggers owned by CCRIFC will be deployed throughout the Salmo River mainstem to determine the effects of temperature on distribution and migratory behaviour. Salmo River discharge is monitored continuously and would be correlated against the bull trout migratory behaviour and the number of bull trout that enter the Seven Mile Reservoir.

A fixed receiver station placed at the mouth of the Salmo River to quantify the number of bull trout entering the Seven Mile Reservoir would operate throughout the year. Bull trout that enter the Seven Mile Reservoir during winter and return during the spring are likely adfluvial fish.

A second fixed receiver station will be placed adjacent to the Seven Mile Dam tailrace prior to spring freshet to monitor entrainment year-round. The rate of bull trout entrainment will be related to Seven Mile Dam operations (rate and extent of reservoir drawdown). Each receiver station will scan through the entire list of coded frequencies every ten seconds and therefore should identify any presence of a radio tag in the tailrace.

Subadult bull trout mortality rate would be determined when tags are relocated near carcasses or in and/or around eagle and osprey nests. Radio–tagged bull trout that have been predated typically show minor damage such as teeth, talon or claw marks or damaged antennae etc (Tiley, personal observation). Poached bull trout typically show no signs of damage and sometimes efforts made to hide the tag are obvious (Tiley, personal observation).

Floy tags would be used to calculate a population estimate. Anchor-type floy tags can have good retention rates after one year of application (Baxter et al, 1999). Snorkel surveys would be conducted at night once per year following spring freshet by which time lower flows and clearer water conditions would facilitate greater observer efficiency. All bull trout observed would be counted, but would be segregated into adult and subadult categories based on length. The floy tag would provide means of calculating a Petersen mark-recapture population estimate. The Petersen mark-recapture could be described as follows: (number of fish marked and released X total number of observed bull trout)/ number of floy tags observed. The triple tagging method would provide observer efficiency and tag retention information as the radio tags would indicate the number of floy-tagged fish within the area surveyed.
A unique colour will be used each year to monitor population trends.

Bull trout length and weight would be determined and scales and tissue samples would be collected. Length-frequency distribution will be used to estimate the age of individual fish. Ageing of Salmo River bull trout using scales and otoliths has previously been done. This data would be used to validate age estimates based on length-frequency. Scale and genetic samples will be collected for future analysis in anticipation of potential future studies.

Table B-1 Detailed Budget

Item	Unit Price ($)	Quantity (five years)	Total Cost ($) (five years)
4.5g Nano tags	373	100 (20 x 5yr)	37300
Floy Tags	3	100	300
PIT tags	5	100	500
Surgical Equipment	300/year	300 X 5 years	1500
Receiver	15000	1	15000
Vehicle Travel	.40/km	5000 km	2000
Raft rental	100/day	28 days	2800
Thermometer	25	2	50
Stationary	25	5	125
Weigh scale	1	100	100
Field Labour			
Lead Biologist	350/day	125	43750
Technician 1	200/day	125	25000
Technician 2	17/hr	520	8840
Office Time			
Project manager	350/day	25	8750
Lead Biologist	350/day	30	10500
Office Equipment	50/year	50 X 5years	250
Total			**$156,765**

1.6 Measurement of success

The number of data points for a given tagged fish will determine how successful the study is in identifying the distribution and habitat preference of sub adult bull trout. Weekly tracking should ensure that the movement of each fish within the Salmo River and its tributaries is well documented. Weekly tracking should ensure that subadult distribution and habitat utilization is well defined following the completion of this study, assisting in the conservation management of the Salmo River bull trout population.

The validity of the population estimates, assessed by calculating confidence limits, will depend on the number of unmarked and marked bull trout observed. James Baxter has extensive snorkelling experience and is very familiar with the Salmo River. His involvement will likely ensure that the best possible data will be collected. It is hoped that confidence limits will approach 95%.

The number of bull trout that enter Seven Mile Reservoir and become entrained is a priority issue of CCRIFC. The impact of entrainment on the Salmo bull trout population should be determined so that an informed decision can be made within the context of the Seven Mile Water Use Plan. The percentage of bull trout that become entrained would indicate the significance of entrainment to the recovery of the Salmo River bull trout population. The significance of entrainment will depend on whether or not an adfluvial

bull trout population exists in Seven Mile Reservoir. If entrainment rate is greater than 20%, then significant impact to an adfluvial population may be occurring.

In his review of the draft consultative report, Hugh Smith noted that the handling and tagging of the fish may lead to behavioral changes or mortality, which could be a possible source of error in this study design.

1.7 Benefits/Risks

The data obtained from the proposed study would be invaluable to Tribal and Government Agencies in establishing bull trout management and enhancement objectives. For example, areas of high subadult bull trout density could be closed to fishing indefinitely, ensuring long-term persistence of the population. Habitat enhancement projects could be based on habitat requirements identified through the proposed study. BC Hydro could incorporate the results obtained from this study into the Seven Mile Water Use Plan. BC Hydro may reduce the rate of entrainment, if found to be significant, by reducing reservoir drawdown during the winter when bull trout would most likely utilize the reservoir, or install devices such as strobe lights that deter bull trout and other native fish species from entering turbine intakes. The number of bull trout that re-enter the Salmo River from Seven Mile reservoir may indicate whether bull trout are being involuntarily flushed into the reservoir. The frequency, timing and extent of downstream subadult movement in relation to Salmo River discharge may also indicate whether an adfluvial bull trout population exists.

1.8 Animal Care

Clove oil diluted at 2ml: 20L stream water bath will be used to anaesthetize bull trout during radio tagging, floy tagging and PIT tagging. No mortality as a result of the surgical procedures were observed by Baxter & Nellestijn (2001).

1.9 Literature Cited

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BC Conservation Data Centre. 2001. World Wide Web Site address http://www.elp.gov.bc.ca/rib/wis/cdc/ on October 31, 2001.

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Bonneau, J.L. and D. Scarnecchia. 1996. *Distribution of bull trout in a Thermal Gradient of a Plunge Pool in Granite Creek, Idaho.* Transactions of the American Fisheries Society. 125: 628-630.

Hammond, J. A Bull trout harvest moratorium was implemented throughout the Salmo River and tributary streams to assist in the recovery of the bull trout population which was shown to be an effective management practice in the recovery of other bull trout populations that had declined as a result of over-harvest and possibly poaching (i.e. Stelfox, 1997).

RL&L Environmental Services Ltd. 1995. *Seven Mile Unit 4 Study: Fish and aquatic investigations, September 1994 to June 1995 – study results and impact discussion.* Draft Report Prepared for BC Hydro. R.L.&L. Report No. 434-95D: 161 p. + 87plates + 6 app

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Stelfox, J. D. 1997. *Seasonal movements, growth, survival and population status of the adfluvial bull trout population in Lower Kananaskis Lake, Alberta.* Pages 309 –316 in Mackay, W.C., M.K. Brewin, and M. Monita, editors, Friends of the bull trout conference proceedings. bull trout Task Force (Alberta), c/o Trout Unlimited Canada, Calgary.

Swanberg, T. R. 1997. *Movements of and habitat use by fluvial bull trout in the Blackfoot River, Montana.* Transactions of the American Fisheries Society. 126: 735-746.

1.10 Extension/Public

Annual progress reports will be submitted to CCRIFC, participating Government agencies and interested public interest groups. Annual presentations will be made to the citizens of Salmo and the Salmo Watershed Stream Keepers Society.

APPENDIX C: TRIBUTARY ACCESS IN SEVEN MILE RESERVOIR

Memo: Seven Mile Tributary Access Notes
From : CCRIFC, Mark Tiley
Date: September 10, 2001
To: Seven Mile WUP Committee

The purpose of the following reconnaissance surveys carried out by CCRIFC Hydro Impacts Biologist Mark Tiley was to determine whether some of the organic debris barriers and some other types of barriers identified by RL&L (1995) should still be considered impassable to native migratory fish that may utilize the tributaries for spawning and rearing. Subjective notes were made regarding the presence/absence of barriers, affects of drawdown on fish accessibility, gradient, spawning habitat availability, etc.

March 13, 2001 Field Trip
Reservoir Elevations: 526.0-528.8meters

June 4, 2001 Field Trip

Reservoir Elevations:		
	mean:	522.92 meters
	Min:	521.73 meters
	Max:	524.27 meters

Charbonneau Creek

A waterfall barrier running over bedrock was present approximately 60 meters (m) upstream from the observed reservoir elevation on March 13, 2001.

Fraser Creek

On March 13, 2001, too much snow cover inhibited walking, and covered most of the stream, preventing meaningful information from being collected.

July 4, 2001

Fraser Creek was walked for approximately 1 km upstream from the beginning of the riparian zone. A debris jam was observed within the drawdown zone from the observed reservoir elevation to the mouth of Fraser Creek, possibly the result of low flow conditions. 200m upstream from the riparian zone another low-flow barrier was observed. Other potential low-flow barriers were observed throughout the survey. Fraser Creek gradient was high, resulting in low habitat suitability for rainbow and bull trout spawning. Rearing habitat appeared low to fair.

Harcourt Creek

On March 13, 2001, too much snow cover inhibited walking, and covered most of the stream, preventing meaningful information from being collected.

July 4, 2001

Walked approximately 1 km upstream from the riparian zone. No definite barriers were observed until a 15 to 20ft vertical waterfall barrier was observed. Several possible barriers at low flows created by large and small woody debris jams were observed; however, it seems probable based from the estimated bankfull height that barriers caused by organic debris jams would probably be passable during moderate to high flow conditions. High numbers of benthic invertebrates were observed. Stream gradient is steep and

therefore little retention of spawning gravels occurs. Observed gravels were also poorly worked, indicating rapid movement of bed material out of system. Rearing habitat for juvenile salmonids appeared to be fair at observed flow conditions.

Tillicum Creek

March 13, 2001

A three-foot plunge pool was observed at the downstream end of the culvert which may provide enough volume for salmonids to jump into and pass through the culvert. During observed flow conditions and reservoir elevations, some fish species such as rainbow trout and bull trout may be able to access Tillicum Creek from the reservoir.

Tillicum Creek was not walked beyond the road crossing. Stream gradient was low immediately upstream of the culvert. Based on the observed gradient and habitat upstream from the road crossing, Tillicum Creek could support all life history stages of rainbow and bull trout.

Limpid Creek

March 13, 2001

The culvert at the mouth of Limpid Creek hangs approximately 3 ft above the pull pool reservoir elevation and is a definite barrier. An impassable waterfall occurs approximately 30 meters upstream from the road crossing.

APPENDIX D: ATTACHMENT A – OF DFO'S AUTHORIZATION OF SEVEN MILE UNIT 4[1]

ATTACHMENT A

Seven Mile Generating Station

BC Hydro commits to planning operations at the Seven Mile powerhouse, following the commencement of commercial operation of Unit 4, in accordance with the following conditions:

1. During periods when the daily average Pend d'Oreille River discharges at Seven Mile are less than the capacity of the Waneta powerhouse, BC Hydro shall make reasonable efforts[1] to distribute discharges from the Seven Mile powerhouse such that the total instantaneous discharge at the Waneta facilities does not exceed the capacity of the Waneta powerhouse. In the event that actual discharges at Seven Mile cannot be distributed in this way due to:

   (i) unexpected changes in inflows or inflow shaping from the upstream Boundary plant,
   (ii) unforecast high discharges in the Salmo River;
   (iii) a need to respond to unusual system capacity demands, or
   (iv) limits on permissible water level fluctuations of Seven Mile Reservoir

   then BC Hydro shall make reasonable efforts to distribute discharges from Seven Mile powerhouse such that (a) spilling at Waneta is minimized, and (b) the total instantaneous discharge at the Waneta facilities does not exceed the capacity of the Waneta powerhouse by more than 14,000 cfs, i.e. any more than could occur with three units at Seven Mile in combination with four units at Waneta prior to any of the Waneta units being upgraded.

   During the critical white sturgeon spawning/hatching period of June, July and August, BC Hydro shall make best efforts[1] to observe this condition.

2. During periods when the daily average Pend d'Oreille River discharges at Seven Mile are less than the capacity of Waneta powerhouse, BC Hydro shall make reasonable efforts to distribute discharges from Seven Mile powerhouse such that the frequency and magnitude of load flow shaping at Waneta powerhouse does not increase relative to existing or approved future operations. This condition shall have effect up until such time as a Project Approval Certificate is issued to Cominco Ltd in respect of the Waneta Generating Station Upgrade Project.

   During the critical white sturgeon spawning/hatching period of June, July and August, BC Hydro shall make best efforts to observe this condition.

[1] The following is meant by the terms "reasonable efforts" and "best efforts". "best efforts means BC Hydro will do everything short of cutting firm load or incurring legal liability for operations at Seven Mile or elsewhere to keep from increasing spill at Waneta. "reasonable efforts" allows for consideration of economics in prioritizing the options for responding to unusual system demands.

[1] Note that point 2 (addressing the shaping of flows) appears here but does not appear in the Seven Mile WUP (1998). Input from Dave Wilson (BC Hydro) and Steve Macadam (WLAP) indicate that the document included here is the more up to date description of status quo operations. Input from Steve Macadam (WLAP) and Dan Sneep (DFO) indicate that the term limit on item 2 suggests that it does not have to be part of the current WUP.

3. During periods when the daily average Pend d'Oreille River discharges at Seven Mile are greater than or equal to the capacity of Waneta powerhouse, BC Hydro shall make reasonable efforts to distribute discharges from Seven Mile powerhouse such that the powerhouse at Waneta may be run effectively at full capacity for 24 hours per day.

   During the critical white sturgeon spawning/hatching period of June, July and August, BC Hydro shall make best efforts to observe this condition.

4. Conditions 1 through 3 apply when all four units at Seven Mile and all four units at Waneta are operational and capable of running at full capacity, and as long as BC Hydro continues to be party to the Kootenay Canal Agreement[2].

5. Should the results of any environmental monitoring carried out downstream of Waneta by BC Hydro or others indicate that relaxation of any of the above conditions is justified, BC Hydro may approach DFO with a request to relax the conditions and DFO shall consider the request.

[2] Under the terms of the Kootenay Canal Agreement between BC Hydro, Cominco and West Kootenay Power, BC Hydro dispatches power from Cominco and West Kootenay Power plants on the Kootenay and Pend d'Oreille Rivers, including Waneta, to obtain the most efficient overall operation of the projects.

APPENDIX E: LETTER TO WUP MANAGEMENT COMMITTEE FROM DFO, MELP

June 4, 1999

Denise Mullen-Dalmer
Management Committee Chair
Water Use Planning
4th Floor, 1810 Blanshard St
PO Box 9327
V8W 9N3

Dear Denise Mullen-Dalmer:

Re: Seven Mile Dam Water Use Plan

Member agencies of the Management Committee were asked to comment on whether the draft WUP for Seven Mile has satisfied the spirit of the water use plan guidelines, and therefore whether it can be considered a final WUP for submission to the Comptroller of Water Rights. This letter represents the combined comments of the Ministry of Fisheries (Victoria), MELP Regional Fisheries, and the Department of Fisheries and Oceans. The question of whether spirit of the guidelines was met is addressed first, and following that are more specific comments about the draft WUP.

While the format of the draft WUP does not conform to the steps outlined in the guidelines document this is clearly of less concern than whether the content is satisfactory. Steps 1 to 9 cover the process prior to submission, and are therefore relevant to this question. As a result of limitations in the scope of the review, it appears that the guideline steps were not met as early as step 2. Similarly at step 4 the interests and issues of specific water use objectives would have been limited in scope. Both of these limitations have arisen because the draft WUP is based upon the review of the installation of unit 4. That review was limited to addressing incremental impacts of that project, and although there was consideration to the operations of the whole facility there were also some aspects of facility operation that were not addressed. As a result of these limitations we conclude that this draft WUP has not met the spirit of the guidelines.

One of the most significant issues omitted as a result of the limited scoping concerns the storage and operational restrictions. Operations at upstream and downstream facilities have undergone a series of changes over the years, and these changes have not been comprehensively reviewed. Therefore we see WUP as the means to bring all of those issues to the table for discussion.

.../2

With respect to what would be required to make the draft document adequate, our greatest concern is the operation of various hydro facilities upon the hydrograph at Seven Mile, and their resultant fisheries implications. The most significant of these would be Boundary Dam, and its daily peaking operations. Previously neither Seven Mile nor Waneta Reservoirs had a storage license, although both stored water on the daily scale in order to accommodate the peaking operations at Boundary Dam. There is also some concern whether Boundary Dam undertook sufficient consultation with Canada, prior to implementing its upgraded operations. Furthermore, although water management issued a new license for storage at Seven Mile in December of 1998, both the Ministry of Fisheries and MELP Regional Fisheries share a concern that this license was issued without referral or consultation with affected parties. The comptroller's office was made aware of these concerns, and suggested that WUP was the forum for discussion of operational details.

A second concern is that the geographic scope is too limited in the present draft WUP. Seven Mile operations interact with those of other plants in the Canal Plant agreement and also have impacts downstream to the border, and I would suggest that these be characterized in this report. In terms of directly addressing impacts the area included should extend downstream to the Pend d'Oreille/Columbia confluence, and some attention might also be required outside of this impact area.

More detailed comments have been prepared by both DFO and BCFish, and these can be provided to help further preparation of a more comprehensive document. We hope that the development of the 7-Mile WUP will not be an onerous process, but we feel that further work should be undertaken in order to make the Seven Mile WUP compatible with the goals of the WUP program.

I look forward to further input and discussion on this issue.

Sincerely,

Steven McAdam
Senior Biologist Fish/Power
Ministry of Fisheries

Steve Mcfarlane, R.P. Bio
Resource Restoration Biologist
DFO, Pacific Region

APPENDIX F: LETTER FROM CCRIFC TO WATER COMPTROLLER

June 24, 1998

Mr.G.W. Udell,
Project Manager,
Power Supply,
6911 Southpoint Dr.,
Burnaby, B.C.
V3N 4X8

via mail and fax: 604-528-2725

Dear Mr. Udell,

Subject: ***Seven Mile Powerplant - Water Use Plan***

Thank you for providing us with a copy of the draft Water Use Plan for the Seven Mile Dam and Generating Station. Your request for confirmation that the draft plan is consistent with agreements arising out of the Seven Mile Dam Unit Four environmental assessments, and for comments on the draft plan raises a number of important issues:

- The Seven Mile Generating Station Unit 4 Application Review and Recommendations Report prepared by the BC Environmental Assessment Office notes that a new water license will be required for unit 4, and that a Water Use Plan will be required as part of the license. The wording of the report suggests that the WUP will be a part of the water license for unit 4, and that the WUP will therefore be with respect to unit 4 as well. The draft WUP proposes to deal with flow and reservoir regulation of the Seven Mile Generating Station as a whole. Preparation of a WUP for this purpose must be undertaken in a manner consistent with the provincial guidelines for Water Use Planning (when they are finalized.)
- Considerable time has passed since the unit 4 project was authorized pursuant to the BC Environmental Assessment Act. In that time, the legal context for First Nations involvement in the review of projects and activities with the potential to impact on their rights and title has changed very significantly with the 1997 Supreme Court of Canada decision in the *Delgamuukw* case.

Canadian Columbia River Inter
Tribal Fisheries Commission
c/o Ktunaxa/Kinbasket Tribal Council
S.S.#3, Site 15, C-14, Mission Rd., Cranbrook, B.C. V1C 6H3
Telephone: (604)-489-2464 Facsimile: (604)-489-2438

11:50 [illegible] 250 489 2438 BCH AB RELATIONS BRIT LAND & RES. [illegible] BC HYDRO AND RED 003/003

In consideration of these issues, our commission is not in a position to provide confirmation or commentary by June 30th, as requested. We will be seeking direction from Columbia Basin First Nations regarding consultation on the draft Water Use Plan; we will advise you accordingly when this direction has been obtained.

Yours truly,

William Green
Director

cc: Pauline Terbasket, Okanagan Nation Alliance
Thomas Munson, KKTC
Fred Fortier, CCRIFC Chair
Cam Matheson, BC Hydro

APPENDIX G: DRAFT CONSULTATION REPORT ON THE SEVEN MILE DAM AND GENERATION STATION WATER USE PLAN.

Draft Consultation Report

on the Seven Mile Dam and Generating Station Water Use Plan

Prepared for: BC Hydro

Prepared by: Cornerstone Planning Group

February 2000

CORNERSTONE

Draft Consultation Report
on the Seven Mile Dam and Generating Station
Water Use Plan

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1. Introduction

1.1 Purpose of Report

The purpose of this report is to document and verify the consultation activities which were undertaken over the last ten years (1989 - 1999) during regulatory and other relevant processes associated with the Seven Mile Dam and Generating Station (referred to as Seven Mile). This report also summarizes the input received from key interests regarding Seven Mile over this time period.

The Seven Mile hydroelectric generation station is located on the Pend d'Oreille River in southeastern British Columbia near Trail. Specifically, the station is about 18 km. downstream of Seattle City Light's Boundary project and 9 km. upstream of Cominco's Waneta project. The Seven Mile Dam and Powerplant came into service in 1979 and consists of a concrete gravity dam, a spillway, and a 4-unit powerhouse. Three generating units were initially installed between 1979 and 1981. The installation of Unit 4 will complete the project and increase its capacity by approximately 210 MW and increase electricity production by an average of 302 GW.h per year.

The construction and operation of the Seven Mile Generating Station follows the terms and conditions for the beneficial use of water for power purposes as set out in the Water Act.

This report is to support the submission of the Water Use Plan for Seven Mile to the Water Comptroller. It is understood that the Water Comptroller will consider the consultation findings, as well as the adequacy of the consultation process, when reviewing the proposed *Seven Mile Dam and Generating Station Water Use Plan (BC Hydro, Power Supply), September, 1999.*

To this end, this report documents the following:

- the consultation process with key interests between 1989 and 1999, encompassing the early consultation conducted in 1989; the consultation associated with the Seven Mile Generating Station Unit 4 BC Environmental Assessment Application Review and the finalization of the federal Environmental Assessment; and consultation associated with reviews of the draft Water Use Plan;

- the issues raised by key interests through the various processes, including BC Hydro's responses to those issues; and

- the internal analysis of operations; as well as details on proposed mitigation and compensation measures.

1.2 Methodology

The preparation of this report involved the following activities:

- a thorough review of all technical and non-technical studies/reports concerning Seven Mile, as presented in this report's bibliography;

- detailed review and synthesis of materials associated with consultation activities and findings, as documented in the 1989 to 1999 BC Hydro project files for Seven Mile;

- interviews with key BC Hydro personnel that either managed and/or provided their professional expertise to the various studies and/or processes undertaken for Seven Mile; the interviews focused on confirming and elaborating project details, process and activities as sourced through the literature review; and

- review by those involved in the preparation of the agreements leading to the Water Use Plan.

2. Situational Context

The Seven Mile Dam and Generating Station has been the subject of initiatives related to system reviews and regulatory processes over the past ten years. These initiatives have consistently involved extensive consultation.

Since 1989, consultation regarding Seven Mile has taken place, as follows:

- Seven Mile Unit 4 as part of the public consultation on the Lower Columbia Development -1989-93;
- Seven Mile project operations as part of BC Hydro's Electric System Operations Review (ESOR) - 1993-94;
- Seven Mile Unit 4 public consultation conducted under the environmental assessment processes - 1994-96; the process started under the Utilities Commission Act and transitioned to BC's Environmental Assessment Act (BCEAA) in June, 1995; a review under the Canadian Environmental Assessment Act (CEAA) was undertaken in parallel; and
- review of the draft Seven Mile Water Use Plan - 1996-99 - related to the overall operational plan for the facility.

The following chronology of activities carried out as a part of the regulatory approval processes provides further background context:

- a prospectus on the Seven Mile Unit 4 project was submitted to the Ministry of Energy, Mines and Petroleum Resources in July 1994; a copy also was provided to the Department of Fisheries and Oceans (DFO);
- a submission for an Energy Project Certificate was made to the Ministry of Energy, Mines and Petroleum Resources in December 1994; with proclamation of the BC Environmental Assessment Act in June 1995, this became an Application for a Project Approval Certificate;
- the Project Approval Certificate was issued by the province on 25 April 1996;
- Federal Authorization under the Federal Fisheries Act was received on 2 December 1996;
- issue of draft water licence in February 1997;
- an amendment to the Project Approval Certificate, incorporating further agreements reached with fisheries agencies, was issued on 13 March 1997; and

- the water licences were issued in December 1998.

The then existing full operations of the Pend d'Oreille River and the Seven Mile Generating facility were described along with envisioned future operations and provided to those being consulted on the Unit 4 project. This descriptive material was used as a key tool in the assessment and review under the federal and provincial regulatory processes. This included environmental studies carried out in 1994 and 1995 to add to the Columbia River Integrated Environmental Management Plan (CRIEMP) environmental data established between 1990 and 1993.

These assessments, reviews and consultation resulted in the development of a Mitigation and Compensation Plan for the Unit 4 project. The plan was accepted in March 1996 by those involved in the regulatory process, including the federal and provincial agencies. DFO had taken the lead in the negotiations which resulted in the provincial agreement respecting aquatic mitigation and compensation. These requirements were reflected in the April 1996 Project Approval Certificate. The Seven Mile Generating Station Unit 4 Application Review and Recommendation Report (March 1996) issued by the Environmental Assessment Office also referred to the likely need for the preparation of a water use plan.

Both federal and provincial agencies were concurrently reviewing operations at the Waneta Powerplant under a review of a December 1994 application by Cominco to upgrade the Waneta facility.

The reviews, noted above, resulted in DFO expressing an interest in further discussions on Seven Mile operations to balance the interest of sturgeon below Waneta with the then recently agreed powerplant operations detailed in the Unit 4 Certificate. BC Hydro completed an internal trade-off analysis between power generation and fish interests. These further discussions resulted in an operating regime to address the sturgeon interest. This regime was appended to the Federal Authorization (December, 1996).

A draft Water Use Plan (WUP) was initiated for the Seven Mile facility to reflect the various agreements set out in the Unit 4 Project Approval Certificate of April 1996 and the Federal Authorization of December 1996.

Concurrent with the environmental assessment of the project, the province was developing Water Use Plan guidelines. These considerations led to drafts of the guidelines being available in May, 1997. These guidelines were finalized and issued by the province in December, 1998, to frame the development of detailed operating parameters to enhance water management at hydroelectric power and other water control facilities in BC.

The WUP for Seven Mile was revised on various occasions to align with revised drafts of the provincial guidelines. None of these revisions resulted in fundamental changes to the WUP parameters.

3. Consultation Activities

As noted previously, for over a decade, BC Hydro has been undertaking assessments, reviews and other processes in relation to the Seven Mile Dam and Generating Station. This section of the report documents the consultation activities associated with the regulatory and other related processes undertaken by BC Hydro. The consultation activities have involved multiple interests, including:

- federal agencies, mainly Department of Fisheries and Oceans (DFO) with some involvement of Environment Canada;
- provincial agencies, including Ministry of Environment, Lands and Parks (MELP), Crown Corporations Secretariat (CCS), Environmental Assessment Office (EAO), Ministry of Aboriginal Affairs (MAA), Ministry of Employment and Investment (MEI), Ministry of Transportation and Highways (MOTH) and Ministry of Fisheries;
- regional and local governments, including Regional District of Central Kootenay (RDCK) and Regional District of Kootenay-Boundary (RDKB), Cities of Trail and Rossland, Villages of Warfield, Fruitvale, and Montrose;
- local stakeholder groups and companies, including Cominco, Trail Wildlife Association, Castlegar and District Wildlife Association, West Kootenay Fly Fishers, and local residents of the Pend d'Oreille Valley; and
- First Nations, including Canadian Columbia River Inter-Tribal Fisheries Commission (CCRIFC), Ktunaxa-Kinbasket Tribal Council (KKTC), Okanagan Nation Alliance (ONA), and Shuswap Nation Tribal Council (SNTC).

Figures 1 and 2, as described below, present for each of the key interests, a record of the consultation activities by year and month:

- **Figure 1: 1996 to 1999 Consultation Activities** which covers processes after provincial and federal agreement to the Unit 4 Mitigation and Compensation Plan, as well as activities associated with finalizing the draft Water Use Plan for Seven Mile; and
- **Figure 2: 1993 to 1996 Consultation Activities** which covers processes associated with the development of the application for a project approval certificate for the installation of Unit 4 at Seven Mile, as well as the completion of the Seven Mile Unit 4 Mitigation and Compensation Plan.

3.1 Overview of 1996 to 1999 Consultation Activities

As presented on Figure 1, there was considerable activity throughout this time period involving all of the key interests.

In 1996, most of the activity focused on consultations and negotiations with DFO. Initially, activity involved the establishment of the Habitat Compensation Agreement. Although provincial and First Nations representatives participated in the development of the agreement, DFO was the lead agency. After the provincial mitigation and compensation agreement was in place, an additional series of negotiations occurred between DFO and BC Hydro in response to DFO's concerns about sturgeon downstream of Waneta Dam. This led to the issuing of a Federal Authorization which satisfied DFO's requirements.

In 1997, additional consultation activities were undertaken by BC Hydro in relation to the finalization of the Seven Mile Dam and Generating Station Water Use Plan. The draft WUP was distributed to federal and provincial agencies, and First Nations for review and comment. BC Hydro also solicited local governments and stakeholders for feedback on the draft WUP. A number of presentations and discussion forums, both formal and informal, were organized with the local governments and stakeholders.

In 1997/98, BC Hydro and Cominco were in frequent communications regarding the preparation of the draft water use plan for Seven Mile. Cominco provided written clarifications and comments on the Seven Mile draft WUP to BC Hydro for consideration.

First Nations, through CCRIFC, were provided with various versions of the draft WUP for review and comment. Meetings were held with CCRIFC to present and clarify key points contained in the draft WUP and to identify any concerns CCRIFC had with the WUP. Discussions also took place regarding a preliminary process by which those issues could be resolved. Between 1997 and 1999, a process was established and completed with First Nations representatives to satisfy the training, employment and other agreements which comprised the mitigation and compensation plan for the Seven Mile Unit 4 project.

In addition to the activities noted above, archaeological impact assessment studies were undertaken by the Bastion Group Heritage Consultants in 1997/98. The studies included consultations with various First Nations who had previously indicated interest in the project area (e.g. KKTC, ONA, SNTC, Sinix't Nation and CCRIFC).

Figure 1: 1996 to 1999 Consultation Activities

	Federal Agencies	Provincial Agencies	Local Governments/ Stakeholders	First Nations
1996				
March	• all party mitigation and compensation agreement and federal Habitat Compensation Agreement completed by DFO and BC Hydro and consensus achieved with all parties under the BCEAA and CEAA			
April	• DFO raised additional concerns regarding sturgeon; ongoing negotiations			
Nov.	• draft WUP sent to DFO; informal feedback received that DFO's primary interest is in a WUP that is consistent with fisheries agreements made during the CEAA/BCEAA process	• draft WUP sent to MELP and MEI; informal feedback received that MELP's primary interest is in a WUP that is consistent with fisheries agreements made during the CEAA/BCEAA process		• draft WUP sent to CCRIFC
Dec.	• agreement on sturgeon reached with DFO; issuing of Federal Authorization			
1997				
May	• revised draft WUP guidelines resulting in revised draft WUP provided to DFO	• revised draft WUP guidelines resulting in revised draft WUP provided to EAO, MELP (Nelson/Victoria) and Columbia Power Corporation	• revised draft WUP guidelines resulting in revised draft WUP presentations to: RDKB & RDCK and RDKB Planning & Development Committee • revised draft WUP sent to City of Trail and Cominco for review/comment	• revised draft WUP guidelines resulting in revised draft WUP provided to CCRIFC • presentation on revised draft WUP made to CCRIFC in Revelstoke
July			• local fish and wildlife groups were contacted over the summer to advise them of the draft WUP	
August		• revised draft WUP guidelines resulting in revised draft WUP		

	provided to Water Management Branch of MELP	
Oct.		• ongoing meetings initiated with First Nations to satisfy the agreements in the mitigation and compensation plan for Unit 4

Figure 1: 1996 to 1999 Consultation Activities (continued)

	Federal Agencies	Provincial Agencies	Local Governments/ Stakeholders	First Nations
1998				
June	• WUP revised to comply with latest draft of WUP guidelines; revised draft WUP provided to DFO and Environment Canada; comments sought prior to submission to CWR	• WUP revised to comply with latest draft of WUP guidelines; revised draft WUP provided to EAO, MELP, Ministry of Energy and Mines, Ministry of Small Business, Tourism and Culture; comments sought prior to submission to CWR	• WUP revised to comply with latest draft of WUP guidelines; revised draft WUP provided to RDCK, RDKB, City of Trail and Cominco; comments sought prior to submission to CWR	• WUP revised to comply with latest draft of WUP guidelines; revised draft WUP provided to CCRIFC; comments sought prior to submission to CWR • response letter received noting CCRIFC would not be providing "confirmation or commentary" on draft WUP based on stated objections to draft WUP
July			• response letter received from Cominco providing comments on draft WUP	
Sept.				• meeting with CCRIFC re: draft WUP concerns
1999				
May		• June 1998 draft WUP provided to CCS		
June	• response letter received from DFO, MELP and BC Fisheries providing comments on draft WUP	• response letter received from DFO, MELP and BC Fisheries providing comments on draft WUP • informal feedback received from CCS providing comments on the draft WUP		

3.2 Overview of 1989 to 1996 Consultation Activities

Since 1989, all key interests, including federal/provincial agencies, local governments/stakeholders and First Nations, have actively participated in BC Hydro's consultation processes associated with the Columbia Basin. These consultations included both basin-wide initiatives and facility-specific activities. One particular group that participated in both basin-wide, as well as specific Seven Mile activities was the Fisheries Investigations and Reporting Technical and Progress Review Committee. This Committee was comprised of DFO, MELP and CCRIFC representatives.

Figure 2 presents the details of consultation activities with the key interests from 1993 to 1996. This timeframe covered a most dynamic level of activity on Seven Mile which focused on the regulatory processes associated with the proposed installation of Unit 4. BC Hydro was accountable to the EAO for reviewing, analyzing and documenting the environmental, social and economic consequences of the installation of Unit 4. Stakeholder consultation and agency review played a critical role in fulfilling the EAO's requirements. During this timeframe, the local public also was invited to participate in the application process.

The documents reviewed by key interests included:

- a Prospectus for the Installation of Unit 4 at Seven Mile Generating Station;
- an application for a Project Approval Certificate for the Installation of Unit 4 at Seven Mile Generating Station; and
- the Seven Mile Unit 4 Mitigation and Compensation Plan.

Local First Nations, including CCRIFC, KKTC and Shuswap Nation Tribal Council, actively participated and reviewed the key documents. BC Hydro also met with First Nations, particularly the local Tribal Councils to discuss employment and business development opportunities on basin projects, including Seven Mile. With CCRIFC in particular, regular contact was maintained to discuss basin-wide activities, consultations and fisheries projects. CCRIFC kept its member bands, as well as the Sinix't Nation, informed on the Seven Mile project.

BC Hydro was able to meet the requirements of the EAO in both technical and consultative matters. In the EAO Report of March 1996 it is stated that public concerns have been adequately addressed by BC Hydro's responses. This report also stated that appropriate measures to prevent or mitigate all significant adverse effects are set out in BC Hydro's Mitigation and Compensation Plan, dated March 22, 1996.

Figure 2: 1993 to 1996 Consultation Activities

	Federal Agencies	Provincial Agencies	Local Governments/ Stakeholders	First Nations
1993				
Nov.				• meeting with KKTC and CCRIFC to discuss Columbia Basin Development Program, and Seven Mile Unit 4 project
1994				
March				• 1994 Electricity Plan provided to all First Nations of KKTC, Shuswap Nation Tribal Council, Okanagan First Nations
June			• project introduced to regional/community leaders (Trail, Rossland, Warfield, Montrose, Fruitvale, Pend d'Oreille Valley)	• meeting with Okanagan Nation Tribal Council/ Penticton Band to clarify their interests regarding projects in the Columbia Basin
July	• DFO participated in Seven Mile site visit	• MELP participated in Seven Mile site visit		
August	• project *Prospectus* distributed to federal agencies for comment	• project *Prospectus* distributed to provincial agencies for comment	• project *Prospectus* distributed to local governments for comment • project consultation initiated with public: newspaper ad, media release, toll-free number, project InfoSheet, and *Prospectus* made available	• project *Prospectus* distributed to CCRIFC and KKTC for comment
Sept.			• interviews conducted with approx. 30 local people for socio-economic impact assessment	
Oct.				• meeting with CCRIFC to discuss consultations in Columbia River basin
Nov.			• meeting with RDKB to discuss project, including impacts and possible	• initial meetings with Shuswap Nation Tribal Council and KKTC on

mitigation/ compensation	consultation, employment/ business development opportunities re: basin projects

Figure 2: 1993 to 1996 Consultation Activities (continued)

	Federal Agencies	Provincial Agencies	Local Governments/ Stakeholders	First Nations
1995 Jan.	• *Application* distributed to federal agencies (DFO, Environment Canada) for comment	• *Application* distributed to provincial agencies (MELP, MEI, MOTH, Ministry of Small Business, Tourism & Culture, MAA, & Provincial Agricultural Land Commission)	• *Application* distributed to local government (RDKB, RDCK, & villages of Montrose & Fruitvale) for comment	• *Application* distributed to CCRIFC & KKTC for comment • meeting with CCRIFC & KKTC to discuss capacity requirements
Feb.			• meeting with RDKB and RDCK to provide detailed Unit 4 project briefing • project presentations to Trail Wildlife Assoc. & West Kootenay Fly Fishers	
March				• meeting with Shuswap Nation Tribal Council to discuss Columbia Basin project consultation & issues • CCRIFC participated in Seven Mile site visit
April	• draft *Mitigation & Compensation Plan* provided to DFO for comment	• draft *Mitigation & Compensation Plan* provided to MELP for comment		• draft *Mitigation & Compensation Plan* provided to CCRIFC for comment • meeting with Shuswap Nation Tribal Council • 1st joint planning session (BC Hydro/CCRIFC) to discuss project issues
May				• BC Hydro participated in 1st KKTC Capacity Conference Planning Committee meeting • 2nd joint planning session with CCRIFC to discuss project consultation protocol and fisheries projects
July	• ongoing meetings with DFO to develop the Habitat Compensation			• CCRIFC Management Committee produced

	Agreement	a CCRIFC Project Assessment document; it was distributed to First Nations for comment

Figure 2: 1993 to 1996 Consultation Activities (continued)

	Federal Agencies	Provincial Agencies	Local Governments/ Stakeholders	First Nations
1995				
Sept.			• meeting with RDKB & RDCK on proposed Mitigation & Compensation Plan	• Seven Mile Unit 4 project briefly reviewed by Basin First Nations at CCRIFC workshop on lower Columbia River hydro projects
Nov.	• DFO participated in meeting to finalize the Habitat Compensation Agreement	• MELP & EAO participated in meeting to finalize Habitat Compensation Agreement		• CCRIFC participated in meeting to finalize Habitat Compensation Agreement
1996				
Jan/ Mar	• ongoing agency meetings	• ongoing agency meetings		

4. Key Issues

Over the past decade numerous issues have been raised through the consultation associated with various regulatory and other processes implemented for Seven Mile.

For this report, issues specific to the installation of Unit 4 at Seven Mile, as well as to the entire facility have been categorized as noted below. For each of these categories, the specific concerns associated with the issue are presented, followed by BC Hydro's response to each area of concern. These responses were distilled from the EAO Report, other reports/studies associated with the Unit 4 regulatory processes, and the draft WUP for Seven Mile.

- ***Fish and Aquatic Habitat***
  categories covered include: fish entrainment, fish productivity, gas supersaturation, littoral zone loss, tailwater habitat and white sturgeon spawning and habitat

- ***Wildlife***
  categories covered include: white-tailed deer and migratory birds

- ***Recreation***
  categories covered include: recreational facility impacts, recreational boating, beach and swimming activities, recreational safety and snowmobiling safety

- ***Unit 4 Construction Impacts***
  categories covered include: employment and training, potential impacts on housing, socio-economic effects, potential workforce impacts on recreation, migratory birds, and potential environmental impacts

- ***Unit 4 Traffic Impacts***
  categories covered include: construction traffic impacts and interactions

- ***System Operations***
  categories covered include: head loss at Waneta Dam, operations at Boundary Dam, U.S. and Canadian relations, Boundary Dam consultations, project sequencing, licencing, water temperature and hydrograph

- ***Development of the Draft Water Use Plan***
  categories covered include: facility operation impacts, system operations, and impact on other facilities

- ***First Nations Interests***

  categories covered include: fish and fish habitat, entrainment of fish, ongoing support of fisheries activities, sport fishing, fish access, heritage resources, employment and training opportunities, environmental impacts, environmental management and WUP development.

4.1 Fish and Aquatic Habitat

Issue	Specifics	Response
Fish Entrainment	• concern regarding increased fish mortality through entrainment (esp. related to productivity of rainbow trout, bull trout and other native species) • concerns about losses of these limited numbers of native trout; will require compensation	• BC Hydro has negotiated a Habitat Compensation Agreement (March 1996) with fisheries agencies to compensate for anticipated impacts • BC Hydro has established a Mitigation and Compensation Plan, including measures for off-site tributary habitat enhancement
Fish Productivity	• concern that the impacts to fish and productivity are not known and further study is required; also, requires further investigation in issues of lower water retention time and the impact of reservoir levels on the Salmo River fish barrier	• BC Hydro and DFO agreed to take a conservative approach in negotiating the Habitat Compensation Agreement (March 1996) • although recognized as outside the impact of Unit 4, BC Hydro agreed to upgrading the weir in the lower reach of the Salmo River
Gas Super-saturation	• concern about high total gas pressure (TGP) causing excessive and dangerous dissolved gas levels in fish both upstream and downstream of the dam	• Unit 4 will be designed with upper and lower leading edge seals on the wicket gates to reduce water leakage during synchronous condense operation, thereby reducing or eliminating the release of water with high TGP content • operations of Unit 4 during the freshet would decrease TGP downstream of both Seven Mile and Waneta
Littoral Zone Loss	• concerns about fluctuations in reservoir levels affecting littoral zone habitat in reservoirs, and in some cases tributary access • want to see stabilization	• littoral zones in both reservoirs are not expected to be impacted significantly because incremental changes in daily water level ranges will most likely occur during the low-productive

	of areas susceptible to sloughing • need to ensure that organic debris will not result in stranding	winter period when shallow water fish use is limited

Fish and Aquatic Habitat (continued)

Issue	Specifics	Response
Tailwater Habitat	• concerns raised regarding tailwater habitat conditions (esp. during winter months) as this can limit riverine habitat suitability for fish	• BC Hydro will undertake, contingent on engineering and biological feasibility, the installation of velocity refugia • BC Hydro will undertake monitoring activities as described in the Mitigation and Compensation Plan
White Sturgeon Spawning and Habitat	• DFO concerned about the white sturgeon spawning and rearing habitat in the Waneta Eddy, and on the potential impact of flows and total gas pressure from Waneta on the sturgeon and sturgeon habitat • concern expressed that critical habitat may be adversely affected by load-shaping operations at certain times of the year, particularly during the critical white sturgeon spawning and hatching period of June, July and August	• post finalization of mitigation and compensation agreement reached with fisheries agencies on an operating regime which will minimize the potential for adverse impacts on sturgeon as documented in the Federal Authorization and the draft WUP for Seven Mile

4.2 Wildlife

Issue	Specifics	Response
White-tailed Deer and other species	• concerns about hazards to white-tailed deer and other species attempting to cross the reservoir; specific issues mentioned include the soft ice at edge of reservoir and sloping ice surface at the shore	• fencing to keep deer away is impractical as deer cross the Seven Mile reservoir at random points without any clearly identified migrational routes • a successful white-tailed deer habitat management program has been implemented
Migratory Birds (esp. the Great Blue Heron)	• concern regarding impacts of water level fluctuations on feeding and habitat of the Great Blue Heron and other migratory birds, especially as feeding is in a limited area of littoral shelf in the Waneta reservoir	• any changes in reservoir fluctuations associated with future operations would occur primarily in the winter when herons and other birds migrate south out of the area • no incremental impacts on waterfowl nesting is expected from Unit 4

		because no additional land will be flooded and no changes from the authorized operating level is proposed

4.3 Recreation

Issue	Specifics	Response
Recreational Facility Impacts	• impacts during Unit 4 construction period including concern for potential overcrowding of the local camp sites due to use by project workers	• BC Hydro will impose, as a condition of employment during the construction period, a ban on the use of the campground at the BC Hydro Buckley Recreation site by construction workers as semi-permanent or permanent accommodation
Recreational Boating Beach and Swimming Activities	• concern as to whether the existing boat launch requires redesign to better adapt to water level fluctuations • affects on beach and swimming activities because of operational impacts (e.g. water fluctuations and steep unstable slopes) on the recreational areas • concern that the reservoir eliminated previous aesthetic and recreation values of the river; would like to see general compensation for development of recreation facilities at Rosebud Lake, Fort Sheppard or other suitable off-reservoir sites	• BC Hydro attempts to limit the daily range of reservoir fluctuations during the summer recreational period (June 1 - August 31) to two-thirds of the range allowed for the rest of the year, and limits the rate of change of water levels to one-half the value allowed for the rest of the year • the Mitigation and Compensation Plan addresses recreational concerns, including a contingency for off-site recreational enhancement
Recreational Safety	• concern that existing operations of the Waneta reservoir can have an affect on recreational user safety	• BC Hydro could collaborate with Cominco to facilitate posting of safety signs at informal recreation sites and access points on the reservoirs to advise the public of any hazards
Snowmobiling Safety	• concern about snowmobiles near the reservoir	• ice conditions on the reservoir are deemed to be variable and are not a result of the Seven Mile Unit 4 project • safety of snowmobilers is not considered to be a serious concern since the ice conditions on the reservoir are clearly visible from the shore

4.4 Unit 4 Construction Impacts

Issue	Specifics	Response
Employment and Training	• community interest in opportunities for the training of apprentices, skills upgrading and training programs • want to see that local employment is maximized	• local hiring requirements will be implemented in accordance with the renewed 1997 labour agreement between BC Hydro's subsidiary - Columbia Hydro Constructors - and the Allied Hydro Council • the agreement also provides for equity group employment and pre-employment and skills training opportunities
Potential Impacts on Housing	• concern regarding the potential impacts on local housing and accommodation from workers for Unit 4 project	• population impacts with the installation of Unit 4 are expected to be minimal, especially with local hiring being implemented • socio-economic impact studies noted a wide range of housing options exists for any temporary workers
Socio-economic Effects	• concern about impacts on policing, education and health	• no adverse socio-economic effects associated with Unit 4 were identified • the limited number of in-migrating workers are not expected to have significant impacts • BC Hydro has committed to consult with the regional district to address any socio-economic aspects
Potential Workforce Impacts on Recreation	• concern that the Unit 4 workforce who become familiar with the area may increase pressures on angling, camping and general recreation during construction	• impacts on recreational resources are anticipated to be minimal, especially with local hiring requirements being implemented • studies indicate that angling is a secondary activity for many of the recreational users in the area
Migratory Birds	• want to see limited disturbance of migratory birds during nesting season	• no removal of littoral or upland vegetation used by nesting birds is planned during construction of Unit 4 • storage areas will be revegetated, if necessary
Potential	• want to see procedures followed to deal with	• BC Hydro has addressed environmental impact

Environmental Impacts	sedimentation and runoff, reclamation, revegetation of sites, and construction monitoring • construction activities should be limited to existing developed sites in the valley	issues in the Environmental Management Plan which will be used to guide and monitor construction activities • already impacted areas will be utilized for construction facilities, materials storage, parking and gravel disposal

4.5 Unit 4 Traffic Impacts

Issue	Specifics	Response
Construction Traffic Impacts	• concerns about traffic impacts of construction period on local residents, logging trucks, cattle, and wildlife (white-tailed deer, mule deer, elk, etc.) • would prefer to see high construction activity periods set-up during low deer use periods	• BC Hydro has committed to develop, in consultation with MOTH, the RDKB, local residents, and users, a Traffic Management Plan for review and approval by MOTH, to address community transportation impacts, recreational traffic interactions, and traffic-wildlife interactions • during construction, wildlife mortality associated with traffic interactions will be monitored and if there proves to be a concern, BC Hydro will consult with MELP, MOTH and the RDKB regarding acceptable mitigative options
Recreational and Construction Traffic Interactions	• concern regarding interactions between recreational and construction traffic, esp. traffic accessing the Buckley Recreational Site	• BC Hydro has committed to develop, in consultation with MOTH, the RDKB, local recreational users, a Traffic Management Plan for review and approval by MOTH, to address these issues

4.6 System Operations

Issue	Specifics	Response
Head Loss at Waneta Dam	• concern of impact of Unit 4 on head loss at Waneta Dam and possible need for compensation	• current operations at Seven Mile improve the hydraulic head and flow conditions at Waneta; BC Hydro receives no compensation for this improvement. Although the operation with Seven Mile 4 may reduce this improvement in some conditions, Waneta flow conditions will still be improved compared to an operation without Seven Mile.
Operational Changes at Boundary Dam	• concern that operational changes at Boundary Dam will affect Seven Mile	• changes in operation at the Boundary plant will continue to affect the operation at Seven Mile • currently Seven Mile re-

		regulates Boundary flows to preserve hydraulic head and reduce spill at Waneta and Seven Mile

System Operations (continued)

Issue	Specifics	Response
Boundary Operations	• Ministry of Fisheries concern that fluctuations at Seven Mile occur as a result of Boundary operations and that Canadian fisheries agencies have not reviewed Boundary operational needs • want to see Boundary examined in order to incorporate some potential for limitations with the Seven Mile storage licence (restrictions focused around periods when peaking might disrupt sturgeon spawning – about 1 in 4 years)	• these are issues associated with operations in the U.S. and are outside the control of BC Hydro
U.S. and Canadian Relations	• arrangements regarding operations upstream and future sub-agreements with the U.S.	• there have been a number of "ad hoc" coordinating actions to reduce spill at Seven Mile and Waneta, but there are currently no long term agreements planned
Boundary Dam Consultations	• DFO/Ministry of Fisheries concern whether Boundary Dam undertook sufficient consultation with Canada, prior to implementing its upgrade operations	• these are issues associated with operations in the U.S. and are outside the control of BC Hydro
Project Sequencing	• queries as to sequencing of project in relation to other projects in the Columbia Basin in order to avoid "boom and bust" situations	• project sequencing is beyond the scope of plans for Seven Mile as BC Hydro is not able to control the timing of Columbia Basin power projects proposed by other corporations, such as Columbia Power Corporation
Licencing	• DFO/Ministry of Fisheries concern that although water management issued a new licence for storage at Seven Mile in Dec. 1998, this licence was issued without referral	• the water licences for Seven Mile were required to comply with the agreements made during the various regulatory reviews of the project and, as such, consultation was

	or consultation with affected parties	accomplished through those regulatory processes

System Operations (continued)

Issue	Specifics	Response
Water Temperature	• Ministry of Fisheries concern about water temperature of the Pend d'Oreille which are alleged to be getting warmer • feels it is important to understand the thermal regime, what influences it and then in turn how it may influence sturgeon spawning - need information on which facilities in the U.S. have impacts on temperature	• water temperatures in the Canadian portion of the Pend d'Oreille River are primarily determined by the temperature of the upstream releases; water temperatures in the Seven Mile reservoir are fairly uniform from the surface to the bottom due to the short retention time of the reservoir • these are issues associated with the regulation of upstream operations in the U.S. and are outside the control of BC Hydro
Hydrograph	• DFO/Ministry of Fisheries concerned about the operation of various hydro facilities upon the hydrograph at Seven Mile, and their resultant fisheries implications • believe that Boundary Dam and its daily peaking operations has the most significant impact	• Seven Mile has no material impact on the Pend d'Oreille hydrograph; the reservoir has sufficient capacity for daily pondage, and as such does not affect weekly or seasonal Pend d'Oreille River flows • these are issues associated with the regulation of upstream operations in the U.S. and are outside the control of BC Hydro

4.7 Development of the Draft Water Use Plan

Issue	Specifics	Response
Facility Operation Impacts	• DFO/Ministry of Fisheries concern that the draft WUP is based on the review of the installation of Unit 4 and that review was limited to addressing incremental impacts of that project; although there was consideration to the operations of the whole facility, there	• the operating memorandum addressed the operation of the full powerplant now and as foreseen in the future; BC Hydro went beyond the Unit 4 compensation agreement in the operating regime included in the Federal Authorization • need further

	were also some aspects of facility operation that were not addressed • DFO/Ministry of Fisheries concern that the draft WUP has not met the spirit of the WUP guidelines	information from DFO and Ministry of Fisheries in order to discuss outstanding issues with them

Development of the Draft Water Use Plan (continued)

Issue	Specifics	Response
System Operations	• DFO/Ministry of Fisheries concern that the geographic scope of the WUP is too limited because Seven Mile operations interact with those of upstream plants and other plants in the Canal Plant agreement and also have impacts downstream to the border; want these to be characterized in WUP	• these are issues associated with the regulation of upstream operations in the U.S. and are outside the control of BC Hydro • system operations are covered in various sections of the current WUP
WUP Process and Impact on Other Facilities	• CCS noted that the Seven Mile WUP is being developed in advance of completion of the umbrella paper on how WUPs will be developed for all of the Columbia facilities • questioned whether potential impacts on other facilities were considered when preparing the Seven Mile WUP; if not, this should be specifically indicated in the WUP	• how Seven Mile is tied into the overall system was included in the ESOR and in the operating memorandum for Unit 4 and the WUP • since BC Hydro has not, to date, considered seeking a credit from the System Operating Fund, an internal trade-off analysis of power versus fish interests was conducted

4.8 First Nations Interests

Issue	Specifics	Response
Fish and Fish Habitat	• CCRIFC would like reservoir operating range lowered so that the occasional deep drawdown spikes (7-8 times a year) are reduced or eliminated • CCRIFC concerned about impacts on fish and fish habitat (littoral zone)	• it is necessary to fluctuate Seven Mile reservoir in order to distribute flows to reduce spill at Waneta and to carry out maintenance activities • reduction in the operating range of Seven Mile will increase the probability and duration of spills at Waneta • operational changes to eliminate the occasional deep drawdown spikes would cause spilling and have a detrimental impact on sturgeon habitat; also would not

		meet requirements of the Habitat Compensation Agreement • during periods of peak winter demand, BC Hydro would occasionally draw down the Seven Mile reservoir in order to meet system requirements

First Nations Interests (continued)

Issue	Specifics	Response
Entrainment of Fish	• concerns about entrainment of fish through the turbines	• the Mitigation and Compensation Plan will compensate for losses which may be caused by entrainment, including mitigation measures for off-site tributary enhancement
Ongoing Support of Fisheries Activities	• CCRIFC wants BC Hydro to continue to support the fisheries inventory, enhancement and capacity building projects of CCRIFC member nations	• BC Hydro's commitment to support CCRIFC fisheries programs and capacity building relationships is a matter not directly related to the Seven Mile facility and is being reviewed by BC Hydro's Aboriginal Relations Department separately
Sport Fishing	• CCRIFC wants BC Hydro and MELP to monitor sport fishing during the Unit 4 construction period and amend local regulations as needed	• the need to monitor sport fishing is no longer considered necessary by the agencies and is, therefore, not planned at this time
Fish Access	• as requested by CCRIFC, investigate the effects of increased level changes in Waneta Reservoir on fish access to Cedar Creek, and design a restoration and mitigation program if fish accessibility is reduced by Unit 4	• studies were undertaken and results provided to CCRIFC • addressed through the Habitat Compensation Agreement and the Mitigation and Compensation Plan • access to Cedar Creek should be discussed with CCRIFC
Heritage Resources	• KKTC and CCRIFC want protection of any heritage resources in the area	• an archaeological impact assessment (1998/99) concluded that none of the areas produced any evidence of past aboriginal land use or occupation in the form of archaeological remains • it was noted that no archaeological remains,

		sites or features exist within the subject reservoir area

First Nations Interests (continued)

Issue	Specifics	Response
Employment and Training Opportunities	• KKTC/CCRIFC want to maximize employment and training (Unit 4 construction) of band members through negotiation of an economic benefits agreement between BC Hydro and CCRIFC member nations and tribal councils	• funds were provided by BC Hydro to Columbia Basin First Nations in 1998 for training and skills upgrading courses • the training program was negotiated with CCRIFC on behalf of the Columbia Basin First Nations; the scope of training was widened to allow candidates to take training in fields that would benefit their communities
Environmental Impacts	• KKTC raised concerns about environmental impacts, in a cumulative sense	• environmental impacts will continue to be addressed through the Habitat Compensation Agreement and the Mitigation and Compensation Plan
Environmental Management	• CCRIFC wants to be consulted regarding design of an Environmental Management Plan for Unit 4 • concerns that fisheries compensation plans be implemented with the provision that habitat enhancement, structural integrity and productivity be assured	• CCRIFC will be consulted on the Environmental Management Plan for Unit 4 and other related concerns
WUP Development	• CCRIFC were not part of the licencing process for Seven Mile as a whole and therefore will not provide confirmation or commentary on the draft Seven Mile WUP • WUP should be developed in a manner consistent with the provincial guidelines for water use planning	• BC Hydro has committed to further consultations with CCRIFC regarding outstanding concerns

5. Analysis of Operations

The proposed operating regime for Seven Mile, as noted in BC Hydro's draft WUP, was developed using a process which involved an internal analysis of operations, issues and trade-offs. This process sequentially examined the following subjects:

- existing constraints on the operation of the facility;
- water use considerations;
- key issues; and
- analysis of trade-offs and operating alternatives.

5.1 Existing Constraints on the Operation of the Facility

The first subject examined in developing a WUP for the Seven Mile facility was the existing operating constraints. Operations at Seven Mile are constrained, amongst other things, by activities at facilities located both upstream and downstream (i.e. Boundary Dam and Waneta).

The operating regime objective has been to reduce spilling at both Seven Mile and Waneta by regulating discharges from Boundary Dam through daily fluctuations in the Seven Mile reservoir levels.

5.2 Water Use Considerations

The next step included describing the foreseen future operations with unit 4 installed. The various water use considerations for the Seven Mile facility were considered in the context of the environmental assessment processes. In the case of Seven Mile, water use for purposes other than power generation is limited. The main use of water in the lower Pend d'Oreille River is for electricity generation. Other water uses include recreation and some minor irrigation use. There are no commercial fishing, transportation, industrial or domestic uses. The concern for sturgeon flows became the primary point of the trade-off analysis.

With the exception of water licences granted to BC Hydro and Cominco for the operations of Seven Mile and Waneta respectively, no other water licences have been issued for the Pend d'Oreille River.

During the BCEAA/CEAA process, all water uses were considered including: fisheries, flood control, power generation, traditional uses, riparian rights, water supply and irrigation, navigation and recreation in the Pend d'Oreille River from the upstream end of Seven Mile reservoir to the Seven Mile Dam tailrace. Various studies were commissioned to address the issues identified during the regulatory processes.

5.3 Key Issues

Issues regarding the operation of the Seven Mile facility were identified by key interests during the regulatory processes for Unit 4. As noted earlier in this report, although the studies and reviews were carried out to assess the impacts of installing Unit 4, the operations associated with the entire facility were included in the review. Categories of issues raised have included aspects of:

- fish and aquatic habitat;
- wildlife;
- recreation;
- construction impacts;
- traffic impacts;
- system operations; and
- First Nations interests.

Please refer to Section 4 of this report for a full listing of issues and responses.

5.4 Analysis of Trade-offs and Operating Alternatives

In the end, the trade-off analysis undertaken by BC Hydro for Seven Mile examined the impact of flows on sturgeon versus power generation. Since various issues were being addressed through mitigation or compensation rather than through operational changes, there were three key values which took precedence. These were:

- fisheries values (especially white sturgeon)
- power generation values
- recreational values

The goal of the analysis was to develop an operating regime which accommodated fish requirements, maintained recreational operating agreements and still ensured that BC Hydro would have an economically viable project. There is high potential value for power generation at Seven Mile as demonstrated by BC Hydro's intent to install Unit 4. However, this value was tempered by the needs of the fisheries and recreation uses.

Through examination of operating alternatives, it was discovered that it was not feasible to adopt plant operations at Seven Mile which could address all of the values. Therefore, trade-offs and their associated impacts were considered.

For example, one alternative (to the one proposed in the draft WUP) which was examined previously under the ESOR was to maintain a constant forebay level from June to September. This would alleviate issues associated with the effects of reservoir levels and flow fluctuations (e.g. impacts on recreation). However, this would require much more spilling at Seven Mile and Waneta dams. This additional spilling would then lead to loss of power generation and would not comply with the agreement with DFO on sturgeon habitat. Thus, major changes to the reservoir levels to accommodate recreational values could not be made without adversely affecting both fisheries and power generation values.

As previously noted, BC Hydro has not, to date, considered seeking funding through the System Operating Fund and, therefore, dealt with the trade-off analysis as part of the Unit 4 project approval processes.

By undertaking the internal analysis described above, BC Hydro was able to put forward an operating regime which provides a balance for the competing water interests at this facility. The draft WUP for Seven Mile reflects:

- plant operating agreements reached under the provincial Environmental Assessment Act and Canadian Environmental Assessment Act with MELP (Fisheries) and DFO during the environmental review of the proposed Seven Mile Unit 4 project;
- operating restrictions which address DFO's requests to manage flows to protect sturgeon near the confluence of the Pend d'Oreille River with the Columbia; and

- recognition of recreational values on the Seven Mile reservoir by reducing the degree of reservoir fluctuation during the summer months.

Issues which could not be satisfied through operational changes are being addressed through mitigation and compensation. BC Hydro has completed and/or proposed a number of measures to address issues, as noted:

- ongoing compensatory issues through the Columbia Basin Fish and Wildlife Compensation Program;
- the *Seven Mile Unit 4 Habitat Compensation Agreement* and the *Authorization for Works or Undertakings Affecting Fish Habitat and for Destruction of Fish* to compensate for anticipated impacts;
- the *Seven Mile Unit 4 Mitigation and Compensation Plan* to address fisheries and aquatic habitat, vegetation and wildlife resources, socio-economic effects, land and water use, recreational impacts, heritage resource impacts, and First Nations interests;
- a proposed Unit 4 Environmental Management Plan to address monitoring and control of construction impacts for the duration of the construction period, including a reclamation and revegetation plan for the upland storage/and or parking areas;
- the establishment of a Unit 4 Traffic Management Plan to address traffic-related issues;
- the establishment of a monitoring system to assess the effectiveness of the compensation measures in compliance with the conditions of the DFO Authorization; and
- emergency and flood response measures for Seven Mile Dam and powerplant are in place; as well, response measures are in place for fire control, oil/lubricant containment, hazardous materials containment, drainage sump and pump operations.

6. Conclusion

The Seven Mile Dam and Generating Station has been subject to successive studies and regulatory reviews over the past ten years. Taking into account this activity, it can be concluded that, over time, the spirit and intent of the provincial WUP guidelines has been addressed through these basin-wide and facility-specific (e.g. Seven Mile) processes which have included ongoing consultations with key interests.

In general, BC Hydro has succeeded in building strong community relations with local government and stakeholders that participated in the federal and provincial review processes. There have been no unresolved concerns regarding Seven Mile from the public perspective, leading to the conclusion that their needs have been met.

Notwithstanding, there remain a number of specific issues that have been raised by government agencies and First Nations which need to be addressed by BC Hydro.

Government agencies, particularly the Department of Fisheries and Oceans and the Ministry of Fisheries, have raised a number of concerns which require responses from BC Hydro. These issues fall under the following categories:

- Seven Mile operations;
- basin-wide system operations; and
- Boundary Dam consultation and operations.

The Crown Corporations Secretariat also raised questions regarding the upcoming WUP process for the Columbia Basin and the impact of Seven Mile on other facilities.

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